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Rural-to-Urban Migration and Changes in Health Among Young Adults in Thailand

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Abstract

We investigate the impacts of rural-to-urban migration on the health of young adult migrants. A key methodological challenge involves the potentially confounding effects of selection on the relationship between migration and health. Our study addresses this challenge in two ways. To control for potential effects of prior health status on post-migration health outcomes, we employ a longitudinal approach. To control for static unobserved characteristics that can affect migration propensity as well as health outcomes, we use fixed-effects analyses. Data were collected in 2005 and 2007 for a cohort of young adults in rural Kanchanaburi province, western Thailand. The migrant sample includes individuals who subsequently moved to urban destinations where they were reinterviewed in 2007. Return migrants were interviewed in rural Kanchanaburi in both years but moved to an urban area and returned in the meantime. A rural comparison group comprises respondents who remained in the origin villages. An urban comparison sample includes longer-term residents of the urban destination communities. Physical and mental health measures are based on the SF-36 health survey. Findings support the “healthy migrant hypothesis.” Migrants are physically healthier than their nonmigrant counterparts both before and after moving to the city.

We did not find an effect of migration on physical health. Rural-to-urban migrants who stayed at destination experienced a significant improvement in mental health status. Fixed-effects analyses indicate that rural-to-urban migration positively affects mental health. Return migrants do not fare as well as migrants who stayed at destination on both physical and mental health status—evidence of selective return migration.

Keywords

Rural-urban migration; Health status; Selection; Thailand

Introduction

The fundamental shift in the world's population from predominantly rural to predominantly urban has recently crossed the halfway mark (United Nations 2012a), showing no signs of abatement. Recent projections put the global population at more than two-thirds urban by 2050 (United Nations 2012a). Although this shift is nearly complete in developed countries, this process is currently underway in less developed countries, where the pace of urbanization is now most rapid. Indeed, the vast majority of population growth in the coming decades will be absorbed by urban areas in the developing world (United Nations 2012a).

Urbanization occurs through three interacting processes: (1) rural-to-urban migration, (2) natural increase, and (3) reclassification (Weeks 2008). Migration from rural to urban areas directly contributes to a country's urban transition. Most migrants fall within the young adult age range (i.e., 18 to 29 years old), which are peak childbearing years. Thus, migration also indirectly affects urban growth because fertility among urban-bound migrants contributes to natural increase in urban areas. Natural increase, the population growth that occurs as a result of fertility rates exceeding mortality rates, is a direct and indirect cause of urbanization. Natural increase in rural populations indirectly affects urban growth by driving rural-to-urban migration as a means of alleviating overpopulation relative to the availability of economic opportunities in rural areas. Meanwhile, the rate of natural increase in the urban population directly impacts urban growth by virtue of the relatively young age structure that characterizes urban populations. Reclassification is an administrative mechanism by which urban status is conferred on a formerly rural or peri-urban territory, often because the absolute population size or the population density exceeds a certain threshold. Rural-to-urban migration and natural increase are demographic processes that enlarge the urban population size, which can lead to reclassification as the urban population expands geographically.

Asia and Africa are currently experiencing the most rapid urban growth in the world, while urbanization rates have slowed in other regions that are further along in the urban transition, including the more developed regions of North America and Europe as well as Latin America. In Southeast Asia, about two in five people live in urban areas, and projections put the Southeast Asian population at two-thirds urban by 2050 (Goujon et al. 2012). The urban transition in Asia is particularly consequential because it is the most populous region in the

world and is already home to one-half of the world's urban population (United Nations 2012a).

The focus of this article is the first mechanism of urbanization noted earlier: rural-to-urban migration and its consequences for those individuals who migrate. A key set of these consequences is health-related. Rural-to-urban migration can influence migrants' health and well-being through its effects on affluence, exposure to new environmental risks and benefits, by stimulating changes in cultural expectations and patterns of behavior, and by providing access to resources that were unavailable at the place of origin. These migration-related processes can impact migrants' well-being positively and negatively. A substantial body of literature assesses health outcomes among immigrants to the developed world, but less attention has been paid to the health impacts of internal migration. Although both types of migration entail leaving a familiar environment for an unfamiliar one, international migrants typically face more formidable language and cultural challenges than do migrants who stay within their country's borders. Nevertheless, the adaptations required by migrants moving from a rural setting to an urban one can be profound, especially when they are undertaken outside the context of one's usual social network. With rapid urbanization underway in many developing countries, internal migration—especially rural-to-urban movement—is occurring on an even larger scale than international migration (International Organization for Migration 2005; King et al. 2008).[1]

To explore the health consequences of rural-to-urban migration in the context of a developing country, we use a long-standing rural research field station located in western Thailand. In Thailand, 34 % of the population resides in urban areas, and the United Nations projects that this figure will reach 56 % by 2050 (United Nations 2012b). Thailand represents migration patterns typical throughout much of the developing world, and it exemplifies the changing demographic context that other developing countries will face as they urbanize.

Research on the health effects of migration presents formidable challenges. Many studies face methodological limitations, such as selection bias and a lack of optimal comparison groups (Lu 2010). Migration is a highly selective process. Systematic differences between migrants and their nonmigrant counterparts that exist before any moves occur may confound the relationship between migration and health. Demographic characteristics, socioeconomic status (SES), and personality traits render some people more likely to migrate than others (Bilsborrow et al. 1987; Guest 2003). Similarly, health status may also influence who migrates versus who stays at origin (Jasso et al. 2004; Landale et al. 2000). An association between health status and subsequent migration, known as the healthy migrant effect, has been demonstrated empirically: migrants are typically healthier than their peers at origin and destination (Lu 2008; Palloni and Morenoff 2001). These selection factors impede the attribution of post-migration differences in health status (compared with their nonmigrant counterparts) to the effects of migration. To mitigate selection bias, health status would ideally be measured both before and after migration by implementing a longitudinal study

[1]For a recent extensive review of the health consequences of international and internal migration for Southeast Asians, see VanLandingham and Fu (2012).

design. This approach has several advantages over cross-sectional studies, including the opportunity to measure changes in health status over time and to use statistical techniques that control for unobserved characteristics related to migrant selection (Rindfuss et al. 2007). Differences in *a priori* health status must be accounted for to determine the extent to which the migration process itself impacts health.

Another selection mechanism is the potential effect of post-migration health status on return migration. This has been labeled the "salmon bias" effect, drawing on the metaphor of salmon migrating from the fresh water streams where they hatched to feed in the ocean and then returning to their place of origin to spawn. Because empirical literature on this phenomenon finds that it is often the more compromised or disillusioned migrants who return to origin—in contrast with salmon, among which only the most fit make the return trip—a more appropriate characterization might be the "Midnight Train" effect[2] (Nauman et al. forthcoming). Selective return migration by less healthy migrants may lead to erroneous conclusions about the relationship between migration and health (Abraido-Lanza et al. 1999). Successful migrants (i.e., those who stay at destination) may be healthier than those who return (Palloni and Arias 2004; Turra and Elo 2008). If so, comparing the health status of migrants who stayed at destination with that of their nonmigrant counterparts may produce inflated estimates of migration's effect on health because some relatively less-healthy migrants are excluded from the comparison if they returned to origin. To address possible bias due to the Midnight Train effect, the health status of return migrants should also be taken into account.

Because longitudinal data are difficult and expensive to collect, migration studies often compare migrants with the receiving or sending populations using cross-sectional data collected after the move. However, this approach does not account for potential preexisting systematic differences between the migrant and nonmigrant samples, such as pre-migration health status, demographic characteristics, and SES, which may confound the effects of migration on health outcomes. The optimal comparison group consists of migrants' counterparts who remain at origin, surveyed at the same times as the migrants before and after they moved. This timing makes it possible to assess the extent to which any differences observed between the groups post-migration existed before the migrants left. Such an approach necessitates a sufficiently large baseline sample to capture enough individuals who subsequently migrate.

Our study addresses the aforementioned potential threats to validity by employing a longitudinal design, with data collected pre- and post-migration, among rural-to-urban migrants and their counterparts who stayed in the rural sending communities. Selection effects are evaluated by comparing baseline health status of those who subsequently migrated with those who remained at origin. To determine whether rural-to-urban migration affects the health of young adults, changes in health status from pre- to post-migration are compared with changes in health status among their rural counterparts who did not move

[2]"Midnight Train to Georgia" is a 1973 number-one hit single by Gladys Knight & the Pips. The boyfriend of the song's narrator is a musician who moved from his native Georgia to Los Angeles to become a "superstar, but he didn't get far." He decides to give up, and "go back to the life he once knew."

during the time frame of the study. We then employ a fixed-effects approach to control for the potential effects of enduring and hard-to-measure characteristics that can affect decisions to migrate as well as health outcomes. Finally, we compare the health status of rural-to-urban migrants who stayed at destination with those who returned to origin to examine a potential Midnight Train effect.

Research Objectives

The study's overall objective is to ascertain the impact of rural-to-urban migration on the health of young adult migrants. One related objective is to determine the effects of *a priori* health status on subsequent migration in order to distinguish selection factors from the direct effects of migration on physical and mental health. To accomplish this, the pre-migration health status of those who subsequently moved to urban areas will be compared with the health status of their counterparts who stayed in the rural origin villages. A second related objective is to assess a possible Midnight Train effect—the selective return to origin of less-healthy migrants relative to those who remain at destination—by comparing the health status of rural-to-urban migrants who were reinterviewed at destination with those who moved to urban areas and returned to origin during the time frame of the study.

To achieve these objectives, we address four research questions:

1. Do rural-to-urban migrants differ in *a priori* (pre-migration) health status from their counterparts who stayed at origin?
2. Do changes in the health status of rural-to-urban migrants from pre- to post-migration differ from the health changes experienced over the same period by their counterparts who stayed at origin?
3. Does the health status of rural-to-urban migrants who stay in the city differ from those who return to the village?
4. Does the health status of rural-to-urban migrants differ from the health of longer-term residents in urban destination areas?

Conceptual Model

Our conceptual framework depicts the three potential mechanisms underlying the relationship between migration and health, as shown in Fig. 1. First, individual health status among members of the population at origin may influence who migrates versus who stays. The leftmost box in the figure illustrates the selection effects of health on subsequent migration. Health has been shown to affect migration through a selection process by which those who are healthier or otherwise more robust are more likely to undertake migration, given the strains and difficulties that it entails. The dashed line connecting the first and fourth boxes in the framework indicates correlation between *a priori* health status and post-migration health outcomes (Mechanism 1). Because migrants typically constitute a healthier and more resilient subset of the population, they may retain this health advantage during and after migration and therefore may continue to exhibit healthy outcomes after moving. This is commonly referred to as the healthy migrant phenomenon: health advantages of migrants

are likely to be partly the result of their better health initially relative to their nonmigrant counterparts.

The migration process and adjustment to a new physical and social environment at destination may cause changes in migrants' physical and mental health status. The third box in Fig. 1 represents the effects of migration *per se* on health (Mechanism 2). The migration experience can have both positive and negative implications for health. Disruption of social connections and unfamiliarity with the new environment may lead to stress, loneliness, and anxiety, causing a decline in psychological well-being. Unfamiliar working and living conditions may present physical hazards, subjecting migrants to the risk of injury or illness.

Rural-to-urban migrants are thought to experience more autonomy in the urban environment, where they are free from the social and cultural sanctions that exist in the rural origin community. This could have either positive or negative consequences. If migrants were in some way dissatisfied with their situation prior to moving, the new opportunities at destination and freedom to exercise personal control over their individual identities may result in increased satisfaction and improved psychological well-being. On the other hand, such freedom may lead to changes in behavior that could introduce new health risks: for example, sexual experimentation, which carries the risk of contracting sexually transmitted infections.[3] Thus, the conservative norms of rural communities may be protective as well as restrictive compared with the relative anonymity one might experience in an urban environment. Some migrants might maintain beliefs, practices, and social connections that render them more resistant to some risks, challenges, and dangers in the new environment.

Finally, post-migration health status may influence who stays at destination and who returns to origin. This third mechanism is illustrated by the two ovals at the right side of Fig. 1. The Midnight Train phenomenon postulates that the relatively less-healthy migrants are more likely to return, and those who fare well after a rural-to-urban move are more likely to stay in the city.

Data and Methods

This study employs a longitudinal design using data from a Demographic Surveillance Site (DSS) in Kanchanaburi province, located on Thailand's western border with Myanmar. The Kanchanaburi DSS implements a household-based census of 80 rural villages every two years. Census data are linked longitudinally, providing repeat measures over time for a cohort of participants. The study population for the Health Impacts of Rural-to-Urban Migration (HIRUM) project includes young adults (18–29 years old at baseline) who were enumerated in the 2005 and 2007 censuses and a sample of migrants who moved from rural Kanchanaburi to urban destinations between 2005 and 2007. The group of rural-to-urban migrants includes 179 individuals who had been interviewed in the rural study villages in 2005 and were located and reinterviewed in urban destinations, including metropolitan Bangkok, Nakhon Pathom (the capital city of Nakhon Pathom province, located in metropolitan Bangkok west of the city), and Kanchanaburi City, in 2007.[4] The rural

[3]Anglewicz et al. (2014) found a relationship between rural-to-urban migration and timing of sexual debut, using the same data from Thailand.

comparison group consists of 2,217 individuals who were interviewed in the DSS villages in both years and had not lived outside these villages in the meantime. A subset of individuals who were interviewed in rural Kanchanaburi in both years had moved to an urban area and returned to one of the DSS villages in the meantime. These 113 respondents constitute the return migrants, another important comparison group for this study.[5] We did not attempt to trace individuals or households that moved to destinations other than our urban destinations of interest during the time frame of the study. As part of the 2007 fieldwork, a sample of longer-term urban residents was selected in the main destination communities where the rural-to-urban migrants had settled. This urban comparison sample includes 252 individuals who had lived in the urban destination areas for at least five years.[6]

The survey collected demographic and socioeconomic information, migration history, several health status indicators, and other measures. The Short-Form 36 (SF-36) Health Survey, developed by RAND Corporation and J. E. Ware (Ware and Sherbourne 1992), is a widely used instrument for assessing functional health and well-being. The SF-36 is particularly well-suited for this study because it was designed to detect variations in health status within generally healthy populations. Consisting of 36 questions with scaled response options, the SF-36 is an easily administered and concise way of measuring self-assessed physical and mental health status that has demonstrated accuracy in a wide range of settings (Ware et al. 1998). The SF-36 comprises validated and standardized psychometric scales that measure eight specific dimensions of physical and mental health status, including physical functioning; role limitations due to physical problems; role limitations due to emotional problems; social functioning; mental health; vitality; bodily pain; and general health perceptions. Two summary measures—a mental health component summary (MCS) score and a physical health component summary (PCS) score—are computed by aggregating data from the eight subscales. These summary measures range from 0 to 100 and are computed such that higher scores indicate better health outcomes.

This study uses the SF-36 to assess *a priori* differences in health status that distinguish those who subsequently migrated to urban destinations from those who stayed in the rural sending areas. For the migrant groups, SF-36 measures are compared over time to reveal changes in health status from pre- to post-migration. Changes in health status within the rural comparison group are, of course, unaffected by factors associated with migration, but could be driven by secular trends affecting the overall population of interest. Comparing changes in health status for migrants and the rural comparison group provides leverage on the question of whether rural-to-urban migration affects health outcomes. This study focuses on

[4]These individuals were identified as permanent rural-to-urban migrants (i.e., intending to stay indefinitely) by household members who remained in rural Kanchanaburi. During the follow-up survey in 2007, the fieldwork team inquired about the residence of all household members who were interviewed in 2005. Interviewees informed the survey team if a member of the household resided in a different location, such as the urban areas in this study. The sample of rural-to-urban migrants comprised individuals who were interviewed in Kanchanaburi in 2005 but were identified as rural-to-urban migrants in 2007 by the origin household.

[5]Those who reported moving out of rural Kanchanaburi to an urban destination and staying there for at least one month before moving back to the origin household were classified as return migrants.

[6]Defining a longer-term urban resident as someone who has lived in the urban area for at least five years allows us to (1) include within our urban reference group the vast numbers of young adults who have become quite familiar with urban life but weren't necessarily born in the city; and (2) exclude temporary migrants who have either only recently arrived or frequently come and go. We think that five years is a reasonable cutoff point to make these distinctions because urban residence for that duration of time demonstrates a commitment to an urban orientation. Also, existing studies on residential mobility, including the U.S. decennial census, regularly employ five-year duration measures (Long 1988).

overall physical and mental health status, using the two SF-36 summary measures (MCS and PCS).

Because migrants are self-selected, they often differ in fundamental ways from their peers who do not relocate. In fact, migration is typically associated with sociodemographic selection factors, such as age, sex, and educational attainment. Physical and mental health status may also affect who migrates versus who does not, as illustrated in the conceptual framework. We use multivariate logistic regression to assess the relationship between *a priori* physical and mental health status and subsequent migration while controlling for sociodemographic selection factors. These analyses address the first research question by determining whether those who subsequently migrated were initially healthier, less healthy, or the same as those who remained in the rural villages.

Because the propensity to migrate is not uniform across individuals, migration studies are vulnerable to bias due to endogeneity. Migrant selection is endogenous because it is not random and is likely related to the dependent variable: in this case, health status. Furthermore, the omission of unobserved factors associated with both migration and health status, such as risk-taking propensity, could confound the relationship between the two. Fixed-effects regression mitigates these threats to validity by controlling for characteristics of the respondents that do not change during the time frame of the study, even those that were not measured (Allison 2005). Because this method can be applied when the dependent variable is measured at two points in time for each respondent, it is well suited to this study given that health status was measured pre- and post-migration for those who moved to urban areas and at the same points in time for those who stayed in the rural origin villages. We use fixed-effects regression to assess the effect of rural-to-urban migration on physical and mental health status.

Although fixed-effects regression controls for time-invariant characteristics, some sociodemographic characteristics—such as employment status, educational attainment, and marital status—may change over time, and the change could affect physical or mental health status. We include these as control variables in the fixed-effects regression models so that the *ceteris paribus* effect of rural-to-urban migration on health status can be ascertained. The fixed-effects regressions indicate whether migrants experience changes in health status from pre- to post-migration that are significantly different from health changes observed for the reference group during the same time frame.

We look for evidence of Midnight Train effect by incorporating the sample of return migrants in the series of analyses as described earlier. Logistic regression models determine whether the initial health selection mechanism operates similarly for those who subsequently moved to urban destinations and stayed there versus those who moved to urban destinations and returned to the rural origin villages. Fixed-effects regression models estimate the effects of migration on physical and mental health status for each of the migrant groups, relative to the rural comparison group. These analyses examine whether return migrants fare worse in terms of health status than migrants who stay at destination, which would be consistent with the hypothesized Midnight Train effect.

Finally, using data from the follow-up survey in 2007, we compare the health status of rural-to-urban migrants who stayed in the city and return migrants with the comparison group of longer-term residents of the urban destination areas. We use linear regression to examine differences in physical and mental health status, measured after migration, between the migrant groups and the urban comparison group while controlling for sociodemographic differences.[7]

Results

Sociodemographic characteristics of the migrant samples and the rural comparison group are shown in Table 1. Both migrant groups are, on average, slightly younger than those who remained in rural Kanchanaburi. The proportions of male and female rural-to-urban migrants are nearly equal, but there are more men than women among the return migrants. Women outnumber men in the rural comparison group of Kanchanaburi residents who did not move.[8] The most notable difference is in marital status. Although the majority of rural-to-urban migrants were single before migrating, more than one-half of the return migrants were married before they moved, and most of those who remained in rural Kanchanaburi were also married. Overall, rural-to-urban migrants are more educated than migrants who returned and those who did not move from rural Kanchanaburi. About one-third of the rural-to-urban migrants were students before they moved, but students make up only about 10 % of the return migrants and 4 % of those who remained in the rural villages. Unemployment is significantly more common in the rural comparison group than among both migrant groups. Before they moved, almost three-quarters of the rural-to-urban migrants and about two-thirds of the return migrants were living in the same village or *tambon* where they were born in rural Kanchanaburi, and a significantly smaller proportion of those who remained in the rural study villages were born there. Nearly one-half of both migrant groups had also migrated between July 2004 and the 2005 survey. Although members of the rural comparison group did not move outside of Kanchanaburi DSS villages between the 2005 and 2007 survey waves, about 29 % of them reported prior migration experience between July 2004 and the 2005 survey.

Table 2 presents differences in physical and mental health status between rural-to-urban migrants, rural-urban-rural return migrants, and those who stayed in rural Kanchanaburi province during the time frame of the study. Mean scores for PCS and MCS scales measured at T_0 (in 2005) are compared across groups to reveal differences in *a priori* health status between those who subsequently moved and those who stayed at origin. Differences in post-migration health status are observed by comparing mean PCS and MCS scores measured at T_1 (in 2007) for rural-to-urban migrants, return migrants, and the rural comparison group. Changes over time in physical and mental health status are also compared for the three groups.

Those who subsequently migrated to urban areas and stayed there reported better *a priori* physical health status than return migrants and those who remained at origin. After moving

[7]Analytical models for our logistic, fixed effects, and linear regression analyses described here are included in Online Resource 1.
[8]In rural areas, young men often maintain their residence in their home village while working itinerantly nearby.

to urban destinations, the migrants who remained in the city continued to exhibit better physical health status than return migrants and the rural comparison group. Both migrant groups and those who remained in rural Kanchanaburi experienced slight declines in physical health status over time (i.e., as they aged), but the magnitude of change is not significantly different across groups. These changes in physical health status are depicted in the upper graph in Fig. 2.

Regarding mental health status, a lower mean MCS score was observed at T_0 for those who later moved to urban destinations and stayed there, relative to those who remained at origin. This lower mean score may indicate that those who subsequently migrated were dissatisfied with their circumstances at origin, which may be a factor that precipitated their decisions to relocate. Rural-to-urban migrants experienced the greatest improvement in mental health status from pre- to post-migration, as shown in the lower graph in Fig. 2. Meanwhile, the degree of change in MCS from 2005 to 2007 was not significantly different between the return migrants and the rural comparison group. This suggests a possible positive effect of migration on mental health status for those who move from rural areas to urban destinations and stay there, but not for those who return to origin.

The bivariate comparisons of *a priori* health status and migration discussed earlier and shown in Table 2 and Fig. 2 indicate that prior health status differs between those who subsequently migrated and those who stayed at origin. In particular, rural-to-urban migrants exhibited better prior physical health status than return migrants and the rural comparison group. However, the opposite was observed for *a priori* mental health status: rural-to-urban migrants were worse off prior to moving, relative to those who remained in rural Kanchanaburi. These findings address our first research question: Do rural-to-urban migrants differ in *a priori* health status from their counterparts who remained at origin? These bivariate results suggest that they do. This question is further explored in multivariate logistic regressions analyzing the association between *a priori* health status and subsequent migration, controlling for sociodemographic characteristics that are known selection factors for migration. These results are presented in Table 3.

After we control for sociodemographic characteristics and previous migration, the positive association between prior physical health status and subsequent migration for those who moved to urban destinations and stayed there is no longer statistically significant, although the coefficient still represents a positive association (odds ratio = 1.021, $p = .141$; see the first column of Table 3). The control variables included in the regression model are key selection factors for rural-to-urban migration, as evidenced by their significant coefficients. It appears that some of the physical health advantage of rural-to-urban migrants over those who remain at rural origin is explained by differences between the two groups on associated characteristics, such as age, sex, marital status, education, and occupational status.

As shown in the last column of Table 3, the inverse association between pre-migration mental health status and subsequent migration is significant in this multivariate framework when considering all urban-bound migrants—that is, both those who stayed at destination and those who returned to rural Kanchanaburi ($p = .035$). For all urban-bound migrants, a lower MCS score at T_0 is associated with subsequent migration, after we control for other

selection factors. Although the coefficients for the association between *a priori* mental health status and subsequent migration are the same for rural-to-urban migrants who stayed at destination and those who returned to rural Kanchanaburi (odds ratio = 0.986; see the fourth and fifth columns of Table 3), the results are not significant, most likely because the statistical power is limited by sample size.

We next examine the relationship between rural-to-urban migration and changes in health status for migrants who stayed in the urban destination areas and those who returned to the rural origin villages. Tables 4 and 5 present the results of fixed-effects regressions analyzing the effects of migration status on physical and mental health status. These regression models include control variables for sociodemographic characteristics that may have changed during the time frame of the study. Fixed-effects analyses control for characteristics of the respondents that remain stable over time. In Tables 4 and 5, the first model shows the effect of migration on health status for all urban-bound migrants relative to the rural comparison group; Model 2 presents the effects of migration on health status separately for rural-to-urban migrants who stayed at destination and those who returned to rural Kanchanaburi, in reference to the rural comparison group; and Model 3 shows the effect of rural-to-urban migration, compared with return migration, on health status.

Table 4 shows that migration has no effect on physical health status: none of the coefficients for any of the migrant categories are significant. These findings correspond with the bivariate results presented in the bottom section of Table 2 in that there are no significant differences between groups in the degree of change in physical health status. That none of the coefficients for the control variables other than time (which represents the effects of aging) are significant is not surprising because this is a young and generally healthy sample. Table 5 shows that rural-to-urban migration significantly affects mental health status (see Model 2). In particular, rural-to-urban migrants experience a significant improvement in mental health status from pre- to post-migration, relative to the rural comparison group (ß = 2.154, $p = .014$). However, migration does not have a significant effect on mental health status for return migrants, relative to the rural comparison group (ß = –0.286, $p = .785$).

The findings presented in Table 5 provide evidence of a Midnight Train effect. When all urban-bound migrants (both return migrants and those who stayed at destination) are compared with their counterparts who remained in rural Kanchanaburi, the effect of urban-bound migration on improving mental health status is borderline significant (see Model 1: ß = 1.167, $p = .096$). However, when the two migrant groups are analyzed in separate categories, only rural-to-urban migrants who stayed at destination experienced a positive effect of migration on mental health, relative to the rural comparison group (see Model 2). Furthermore, Model 3 shows a significant and positive effect of migration on mental health status for rural-to-urban migrants who stayed at destination, relative to those who returned to origin (ß = 2.557, $p = .054$). In other words, the improvement in mental health status from pre- to post-migration is contingent on staying at destination. Collectively, these results constitute evidence of a Midnight Train effect in that return migrants fare worse than those who stayed at destination. However, we cannot discern whether return migrants went back to the rural villages because they did not experience as much of an improvement in mental health status as migrants who stayed in the city, or whether return migrants experienced less

of an improvement in mental health status because they did not remain in the city. The latter explanation implies that in addition to migration effects, destination effects are particularly important for improving rural-to-urban migrants' mental health status.

The finding that rural-to-urban migration positively affects mental health status for migrants who stayed at destination prompted a post hoc analysis of the relationship between length of stay at destination and post-migration mental health status. We use linear regression models to estimate the association between length of stay in months and post-migration mental health status, controlling for pre-migration mental health status and sociodemographic characteristics. The results, shown in Table 6, indicate that longer duration at destination is associated with better post-migration mental health status within the time frame of this study.

The last step in our analyses is a comparison of health status measured in 2007 for rural-to-urban migrants, rural-urban-rural return migrants, and the comparison group of longer-term residents in the urban destination areas. We first present sociodemographic characteristics measured in 2007 for these three groups in Table 7. The comparison reveals that migrants who stayed in the urban destination areas share similar characteristics with longer-term urban residents: for example, more than 20 % of both groups were students in 2007, and the majority of both groups are educated at the secondary level or higher. In contrast, return migrants differ from rural-to-urban migrants and longer-term urban residents in that more return migrants are married than single, more are laborers or unemployed, and return migrants are less well-educated.

Results addressing our fourth research question are depicted graphically in Fig.3. On average, higher physical and mental health summary scores were observed for the rural-to-urban migrants who stayed at destination than for the return migrants and longer-term urban residents. These findings are supported in multivariate models that control for sociodemographic characteristics, the results of which are shown in Table 8. In the physical health model, the significant interaction term with a negative coefficient for male migrants indicates that the physical health advantage is enjoyed mainly by female migrants who stay in the city.

Discussion

We used a longitudinal research design to assess the effects of rural-to-urban migration on physical and mental health. Measuring pre-migration health status allowed us to determine the extent to which *a priori* health status influenced who subsequently migrated versus who stayed at origin. With this approach, we are able to empirically examine two phenomena that cross-sectional studies cannot adequately address: the healthy migrant hypothesis and the salmon bias effect, which we renamed the Midnight Train effect. These phenomena are important potential sources of selection bias in research on the health impacts of migration.

We found that when compared with their counterparts at origin, migrants who moved from rural villages to urban destinations scored lower on the mental health component summary (MCS) indicator measured before they moved. In multivariate analyses controlling for

sociodemographic selection factors, mental health status is inversely associated with subsequent urban-bound migration. After moving to the city, those who stayed in the urban destination areas experienced a significantly greater improvement in mental health status than the rural comparison group and migrants who returned to the origin villages. The improvement in mental health status among rural-to-urban migrants who remained in the city was large enough to effectively eliminate their previous (pre-migration) disadvantage on this measure. Return migrants did not experience a similar improvement in mental health status, which provides evidence of a Midnight Train effect. We cannot discern whether their return was precipitated by a lack of improvement in mental health status, or whether they did not experience a significant improvement in mental health status because they returned. We did, however, find a linear relationship between duration of stay at urban destination and better mental health status within the time frame of this study for rural-to-urban migrants who stayed at destination. This suggests an important influence of destination effects on mental health status.

We observed a slight decline in physical health status for both migrant groups and the rural comparison group. Because the degree of change in PCS was similar across groups, we did not find an effect of rural-to-urban migration on physical health status. The slight decline in physical health status can be attributed to aging, which presumably affects all study participants to approximately the same extent. Both before and after migration, rural-to-urban migrants who stayed at destination had better physical health status than return migrants and those who remained in rural Kanchanaburi. However, we did not find a significant association between *a priori* physical health status and subsequent migration within a multivariate framework. This suggests that the observed physical health advantage for migrants is largely accounted for by sociodemographic characteristics that are selection factors for migration. In related work, we found that scoring particularly low on the PCS measure precludes migration[9] (Nauman 2013), which contributes to the healthy migrant phenomenon that we observed. Relative to the rural comparison group, migrants who stayed at destination have a physical health advantage that persists from pre- to post-migration, but return migrants do not have this advantage. Although we cannot confirm it with the results of this study, we speculate that some migrants may return to their rural homes if they do not enjoy the physical health advantages that benefit those who endure in the city.

Comparing post-migration health status with the health status of longer-term residents in the urban destination areas revealed that rural-to-urban migrants living in the city have better physical health status than longer-term urban residents. This finding is consistent with healthy migrant selection, which is most likely the reason for the observed difference given that migration did not impact physical health status. Migrants living in the city also have better mental health status than longer-term urban residents. This may be due to the novelty of city life, which is a plausible reason for the positive effect of rural-to-urban migration on mental health status. Successful rural-to-urban migrants may also maintain some aspects of

[9]Those who scored lower than 1 standard deviation below the mean PCS score were only one-half as likely to move to the city and stay there as those with normal or high PCS scores (odds ratio = 0.494, $p = .027$). There was not a significant association between low PCS and subsequent rural-urban-rural migration for return migrants (odds ratio = 1.391, $p = .205$). Models controlled for the same sociodemographic characteristics as shown in Table 3.

their rural lifestyles, such as social patterns and perspectives, that render them resistant to some of the stressors of city life that wear on longer-term urban residents.

The observed patterns of physical and mental health fit well within our conceptual framework. Rural-to-urban migrants likely experience greater autonomy in the urban environment after being released from social and cultural constraints of the rural origin community. This result suggests that before moving to urban destinations, migrants-to-be may have been dissatisfied with rural life, which may have enticed them to migrate to urban destinations, leading to an improvement in mental health status large enough to eliminate the mental health deficit that they experienced prior to migration (at least for those who stayed in the city). For physical health, given the extensive research supporting the healthy migrant phenomenon, it is not surprising that migrants have better physical health than other groups, both before and after migration.

Our results clearly demonstrate the merits of using a longitudinal study design in which health status is measured before and after migration. The comparisons of post-migration health status versus the rural comparison group shown in the middle section of Table 2 and post-migration health status versus the urban comparison group shown in Fig. 3 exemplify the results that would have been obtained by implementing a typical cross-sectional study design in which the health status of rural-to-urban migrants located at destination is compared with that of their nonmigrant counterparts at origin and destination. We observed that after migrants move to the city, they are physically healthier than their counterparts living in rural Kanchanaburi and longer-term urban residents. Without observing pre-migration health status, we would not have known whether migrants' physical health advantage existed before they moved, or whether better physical health status was a product of migration itself. The longitudinal results showed that the physical health advantage for migrants who moved to the city and stayed there existed before they left rural Kanchanaburi, and indicated that rural-to-urban migration does not affect physical health status. The longitudinal findings verify that the superior physical health status of rural-to-urban migrants living at destination is due to healthy migrant selection effects. Therefore, attributing post-migration differences in physical health status to the effects of migration would be an erroneous conclusion, resulting in a Type I error.

In terms of post-migration mental health status, rural-to-urban migrants living at destination are comparable with their counterparts at origin. Without observing the changes in mental health status from pre- to post-migration and over the same time frame for the rural comparison group, it would seem that rural-to-urban migration may not impact mental health at all, given the lack of a significant difference between the two groups in 2007. However, the pre-migration data showed that *a priori* mental health status was significantly lower for those who subsequently migrated than for those who remained at origin. Rural-to-urban migrants who stayed in the urban destination areas experienced an improvement in mental health from pre- to post-migration, which eliminated the difference between them and the rural comparison group by 2007. The longitudinal analyses revealed a significant effect of rural-to-urban migration on mental health status for migrants who stayed at destination. This important relationship between rural-to-urban migration and mental health status would have been missed with a cross-sectional approach, resulting in a Type II error.

Contrasting the cross-sectional and longitudinal findings reveals the significant limitations of cross-sectional approaches to migration studies. A key advantage of using longitudinal data is that selection effects can be differentiated from migration effects in order to better explain the bidirectional relationship between migration and health. The use of fixed-effects regression is also a strength of this study because this method controls for unobserved time-invariant characteristics of the respondents, which mitigates bias due to migrant selection. This is particularly important because some individual attributes that influence migration propensity are difficult or impossible to measure accurately.

A DSS-based design presents both advantages and limitations for migration studies. On the positive side, the repeated measures focusing on households and villages over time make possible the longitudinal perspective that is so critical to understanding the causes and consequences of migration. The permanent field office in a rural area of the province with its full-time staff provides tremendous logistic advantages. Regarding limitations, a DSS does not follow households and individuals that relocate outside of the study area. Although we followed migrants to urban destinations of interest in this study, a DSS is not ordinarily designed to follow such individuals, requiring substantial expenditures of resources to do so. Constraints in resources for this migration follow-up limited this study in two important ways. First, our sample size of rural-to-urban migrants is relatively small and therefore not sufficient to permit a comparison of the relationship between migration and health across the three urban destinations. Second, we did not follow individuals who migrated to destinations other than metropolitan Bangkok (including Nakhon Pathom) and Kanchanaburi City, and we miss some household members who were working itinerantly outside of the study villages at the time of data collection.

More generally, because of the challenges associated with tracking migrants, longitudinal migration studies face the key limitation of attrition. Based on reports from origin households in rural Kanchanaburi, 146 individuals from our baseline sample had reportedly moved to urban destinations, but we were unable to locate and reinterview them. To assess potential biases in our migrant sample associated with this attrition, we compared baseline health status and sociodemographic characteristics for migrants who were reinterviewed in urban destination areas and supposed rural-to-urban migrants who were not found. Bivariate comparisons of mean PCS and MCS scores show no significant differences between the two groups in pre-migration physical or mental health status. In multivariate models, educational attainment and being a student before migration are positively associated with being reinterviewed at destination (vs. migrants lost to follow-up).[10] Many migrants with these characteristics probably moved to the city to pursue higher education, making them relatively easy to find if they were living on university campuses. We believe that any potential bias introduced as a result of this is likely minimal because these characteristics are not significantly associated with migrants' health status (not shown).

Defining and measuring migration is also an important challenge for research on the relationship between mobility and health. A key contribution of our research is the

[10]Results of the bivariate and multivariate analyses described here are included in Tables S1 and S2, respectively, in Online Resource 1.

comparison of four relevant groups in terms of residence and migration: rural residents, longer-term urban residents, rural-to-urban migrants, and rural-urban-rural return migrants. To group individuals into these categories, we used criteria that we believe to be reliable and established by previous research. We acknowledge, however, that mobility is more nuanced than can be captured by commonly used binary indicators of migration. For example, the rural comparison group could include commuters, who technically reside in rural Kanachaburi but regularly travel to an urban area. Although considered rural residents, these individuals may be exposed to some of the same factors that affect health for rural-to-urban migrants and longer-term urban residents.

The fairly short two-year window between survey waves has both advantages and disadvantages. Although a short time between survey waves can help reduce attrition, it also limits the number of individuals who migrate within that time frame, which restricts the statistical power of the analyses. Also, with a two-year follow-up, we were able to capture only the more immediate effects of migration on health status; health impacts that take longer to manifest were not observed. We believe that the appropriateness of the SF-36 as a health assessment tool for this study is demonstrated by its ability to detect fairly minor changes in dimensions of health status over a fairly short two-year time frame within a generally healthy population of young adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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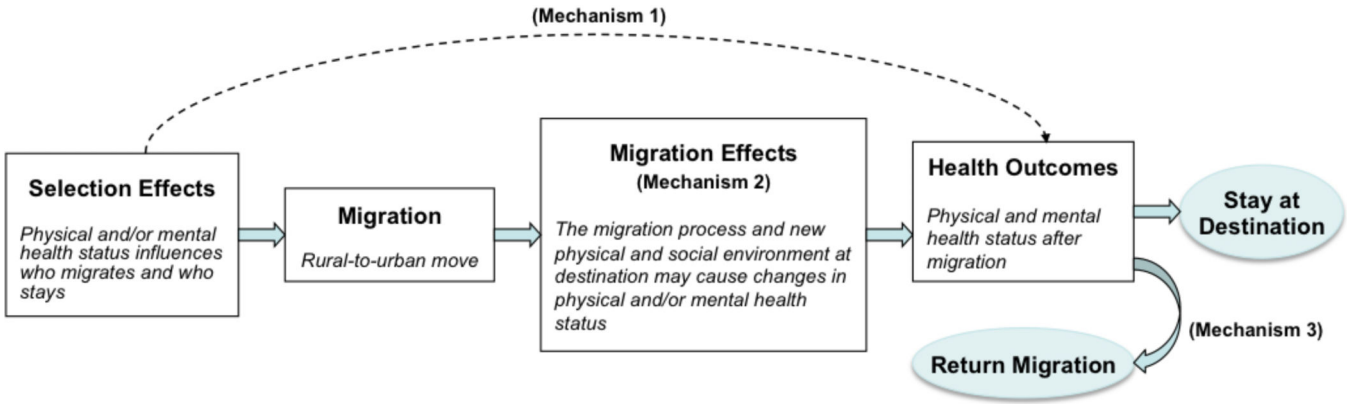

Fig. 1.

Conceptual model: The relationship between health and migration

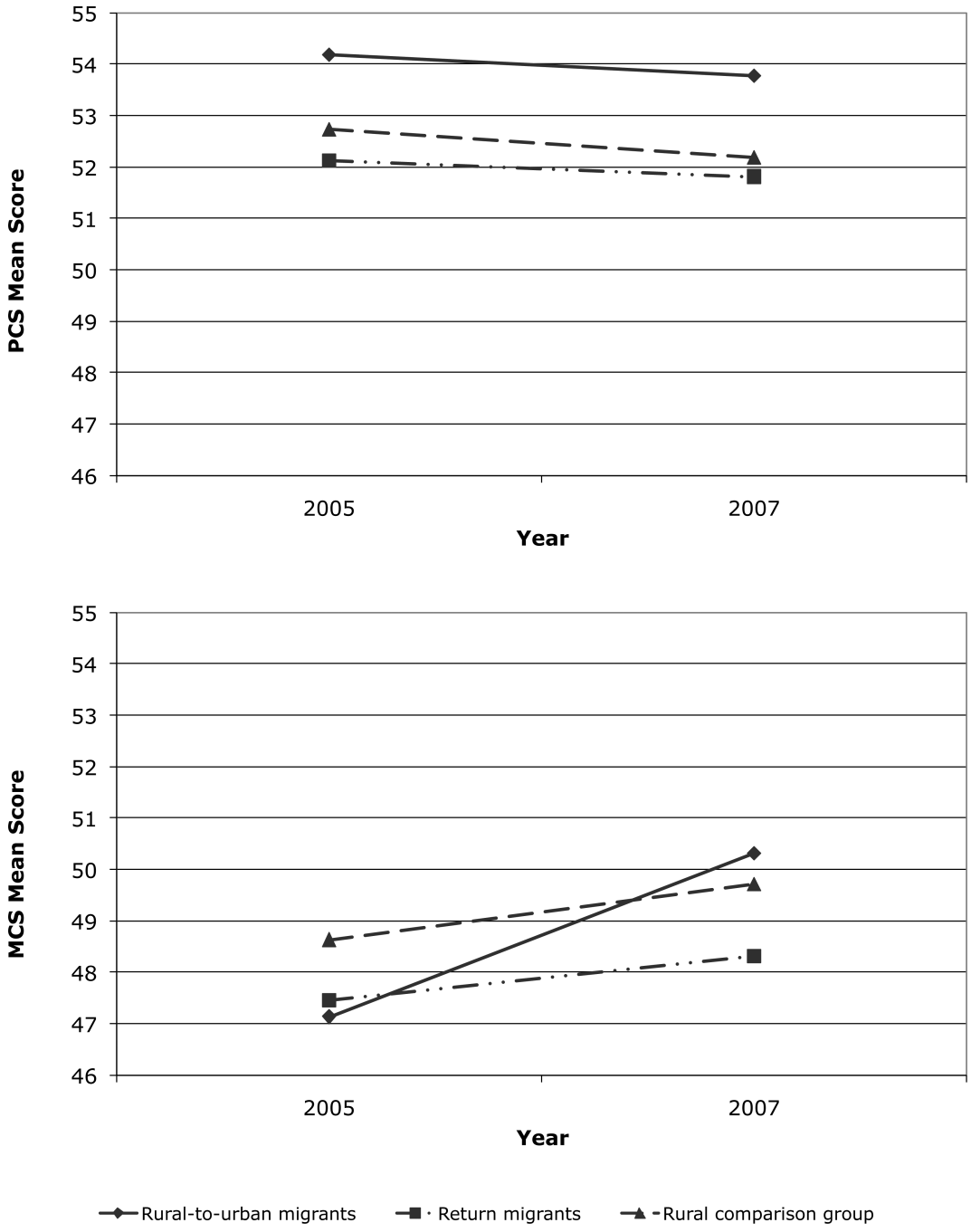

Fig. 2.

Changes in physical and mental health status for rural-to-urban migrants, rural-urban-rural return migrants, and those who stayed in rural Kanchanaburi province

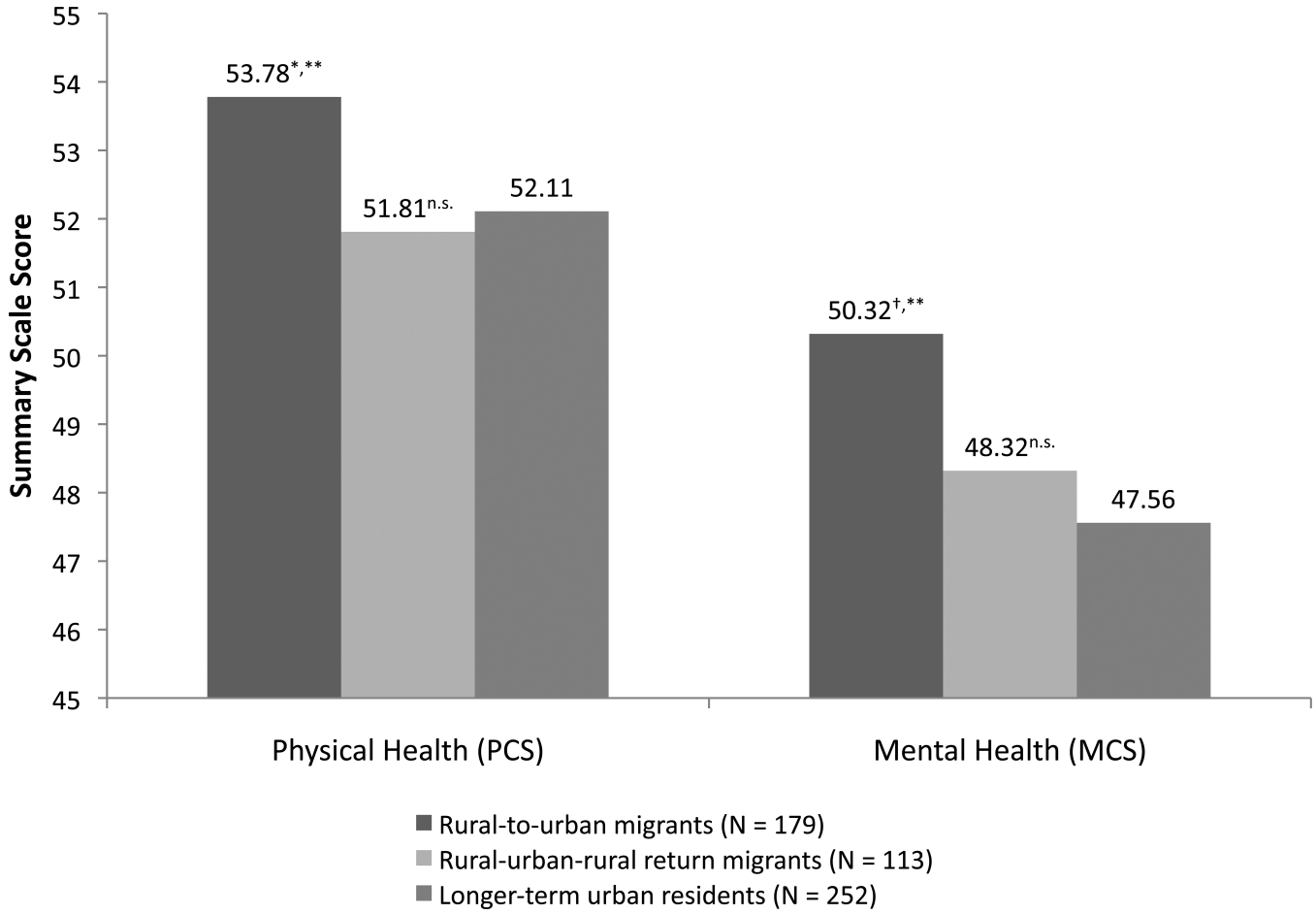

Fig. 3.

Physical and mental health status at T_1 (in 2007) for rural-to-urban migrants, rural-urban-rural return migrants, and longer-term residents of the urban destination areas. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Table 1

Sample characteristics at T_0 (in 2005) for those who subsequently migrated to urban destinations and stayed, rural-urban-rural return migrants, and respondents who remained in rural Kanchanaburi: Means (standard deviations) or percentages (*n*)

Characteristics	Rural-to-Urban Migrants (*N* = 179)	Rural-Urban-Rural Return Migrants (*N* = 113)	Kanchanaburi Residents (*N* = 2,217)
Age (mean years: 18-29)	21 07 (3 11)$^{***, ***}$	22.86 (3.67)***	24.37 (3.43)
Sex (%)			
Male	48.6 (87)$^{*, **}$	59.3 (67)***	36.9 (819)
Female	51.4 (92)	40.7 (46)	63.1 (1,398)
Marital status (%)			
Single	63.1 (113)$^{***, ***}$	42.5 (48)***	25.4 (563)
Married	34.1 (61)$^{**, ***}$	52.2 (59)***	72.0 (1,597)
Divorced, widowed, separated	2.8 (5)$^{n.s., n.s.}$	5.3 (6)†	2.6 (57)
Occupation (%)			
Professional	5.0 (9)$^{n.s., \dagger}$	6.2 (7)$^{n.s.}$	8.3 (185)
Skilled	31.8(57)$^{**, ***}$	50.4 (57)$^{n.s.}$	50.3 (1,116)
Manual labor	19.6 (35)$^{n.s., n.s.}$	19.5 (22)$^{n.s.}$	16.8 (373)
Student	34.6 (62)$^{***, ***}$	10.6 (12)**	4.0 (88)
Not working	8.9 (16)$^{n.s., ***}$	13.3 (15)*	20.5 (455)
Education (%)			
None	1.1 (2)$^{**, ***}$	7.1 (8)$^{n.s.}$	10.1 (225)
Primary (1-6 yrs)	24.0 (43)$^{***, ***}$	44.2 (50)$^{n.s.}$	40.9 (906)
Secondary (7-12 yrs)	58.1 (104)$^{**, ***}$	42.5 (48)$^{n.s.}$	40.9 (906)
Undergraduate/masters (13+ yrs.)	16.8 (30)$^{**, ***}$	6.2 (7)$^{n.s.}$	8.1 (179)
Birthplace (%)			
This village/tambon	73.2 (131)$^{n.s., ***}$	67.3 (76)*	57.8 (1,281)
Other district/province	26.3 (47)$^{n.s., *}$	31.0 (35)$^{n.s.}$	32.8 (728)
Other country	0.6 (1)$^{n.s., ***}$	1.8 (2)**	9.3 (207)
Previous migration (%)			
Migrated between July 2004 and 2005 survey	41.9 (75)$^{n.s., ***}$	48.7 (55)***	28.8 (638)

$^{n.s}$ $p > .10$

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 2

Health status at T_0 (in 2005) and T_1 (in 2007) and changes in health status from 2005 to 2007 for rural-to-urban migrants, rural-urban-rural return migrants, and those who remained in rural Kanchanaburi

SF-36 Summary Scales	Rural-to-Urban Migrants	Rural-Urban-Rural Return Migrants	Rural Comparison Group
Whole Sample	(*N* = 179)	(*N* = 113)	(*N* = 2,217)
PCS at T_0	54.19**,**	52.13$^{n.s.}$	52.74
MCS at T_0	47.13$^{n.s.,*}$	47.46$^{n.s.}$	48.63
Males	(*N* = 87)	(*N* = 67)	(*N* = 819)
PCS at T_0	54.49$^{\dagger, n.s.}$	52.42†	53.75
MCS at T_0	48.00$^{n.s., n.s.}$	48.34$^{n.s.}$	49.23
Females	(*N* = 92)	(*N* = 46)	(*N* = 1,398)
PCS at T_0	53.91$^{*, *}$	51.70$^{n.s.}$	52.14
MCS at T_0	46.30$^{n.s., *}$	46.19$^{n.s.}$	48.28
Whole Sample	(*N* = 179)	(*N* = 113)	(*N* = 2,217)
PCS at T_1	53.78$^{*, **}$	51.81$^{n.s.}$	52.19
MCS at T_1	50.32$^{\dagger, n.s.}$	48.32$^{(b)}$	49.72
Males	(*N* = 87)	(*N* = 67)	(*N* = 819)
PCS at T_1	53.82$^{n.s., n.s.}$	53.00$^{n.s.}$	53.40
MCS at T_1	50.47$^{n.s., n.s.}$	48.13*	50.30
Females	(*N* = 92)	(*N* = 46)	(*N* = 1,398)
PCS at T_1	53.75$^{**, **}$	50.07$^{n.s.}$	51.49
MCS at T_1	50.18$^{n.s., n.s.}$	48.61$^{n.s.}$	49.38
Whole Sample	(*N* = 179)	(*N* = 113)	(*N* = 2,217)
Δ PCS from T_0 to T_1	–0.41$^{n.s., n.s.}$	–0.32$^{n.s.}$	–0.54
Δ MCS from T_0 to T_1	3.19$^{\dagger, *}$	0.86$^{n.s.}$	1.09
Males	(*N* = 87)	(*N* = 67)	(*N* = 819)
Δ PCS from T_0 to T_1	–0.6$^{n.s., n.s.}$	0.58$^{n.s.}$	–0.35
Δ MCS from T_0 to T_1	2.46$^{n.s., n.s.}$	–0.21$^{n.s.}$	1.07
Females	(*N* = 92)	(*N* = 46)	(*N* = 1,398)
Δ PCS from T_0 to T_1	–0.17$^{n.s., n.s.}$	–1.63$^{n.s.}$	–0.66
Δ MCS from T_0 to T_1	3.87$^{n.s., *}$	2.42$^{n.s.}$	1.20

$^{***}p < .001$

$^{n.s}p > .10$

$^{\dagger}p < .10$

$^{*}p < .05$

** $p < .01$

Table 3

Association between physical and mental health status at T_0 (in 2005) and subsequent migration, controlling for sociodemographic characteristics: Odds ratios, with standard errors shown in parentheses

Covariates	Rural-to-Urban Migrants (*N* = 2,395)	Rural-Urban Return Migrants (*N* = 2,329)	All Urban-Bound Migrants[a] (*N* = 2,508)	Rural-to-Urban Migrants (*N* = 2,395)	Rural-Urban Return Migrants (*N* = 2,329)	All Urban-Bound Migrants[a] (*N* = 2,508)
SF-36 Summary Scales						
PCS at T_0 (continuous)	1.020 (0.014)	0.976† (0.014)	0.999 (0.011)	—	—	—
MCS at T_0 (continuous)	—	—	—	0.986 (0.009)	0.986 (0.010)	0.986* (0.007)
Control Variables						
Sex (ref. = female)	1.183 (0.185)	2.129*** (0.226)	1.535** (0.149)	1.254 (0.184)	2.072*** (0.225)	1.564** (0.148)
Age at T_0 (continuous)	0.846*** (0.031)	0.925* (0.033)	0.883*** (0.023)	0.849*** (0.031)	0.926* (0.032)	0.885*** (0.023)
Single at T_0 (ref. = married)	1.780** (0.215)	1.452 (0.244)	1.630** (0.168)	1.813** (0.215)	1.440 (0.243)	1.634** (0.168)
Widowed/divorced/ separated at T_0 (ref. = married)	2.170 (0.502)	2.860* (0.462)	2.310* (0.356)	2.132 (0.503)	2.670* (0.463)	2.247* (0.357)
Primary education at T_0 (ref. = no education)	4.788* (0.734)	1.312 (0.396)	1.963† (0.350)	4.691* (0.733)	1.291 (0.396)	1.926† (0.350)
Secondary education at T_0 (ref. = no education)	6.072* (0.728)	0.983 (0.402)	1.960† (0.347)	5.855* (0.728)	0.957 (0.402)	1.901† (0.348)
Higher education at T_0 (ref. = no education)	5.885* (0.766)	0.618 (0.575)	1.668 (0.408)	5.719* (0.767)	0.594 (0.575)	1.628 (0.408)
Working at T_0 (ref. = not working)	2.205* (0.355)	1.274 (0.343)	1.702* (0.251)	2.153* (0.355)	1.262 (0.343)	1.685* (0.251)
Looking for a job at T_0 (ref. = not working)	2.724† (0.587)	1.619 (0.712)	2.175 (0.472)	2.872† (0.585)	1.617 (0.710)	2.213† (0.472)
Student at T_0 (ref. = not working)	9.156*** (0.420)	3.466* (0.506)	7.216*** (0.323)	9.345*** (0.420)	3.360* (0.506)	7.248*** (0.323)
Migrated in last year (ref. = did not migrate)	2.354*** (0.185)	2.188*** (0.204)	2.320*** (0.143)	2.359*** (0.184)	2.204*** (0.205)	2.309*** (0.143)
Goodness-of-Fit Statistics[b]	1	2	3	4	5	6

Notes: The rural comparison group, consisting of those who stayed at origin, are the reference category for the migration status outcome variable. The migrant group of interest is specified at the top of the column.

1.Cox and Snell R^2 = .105; Nagelkerke R^2 = .255; H-L Chi-squared = 6.832, df = 8, p = .555.

2.Cox and Snell R^2 = .030; Nagelkerke R^2 = .094; H-L Chi-squared = 5.960, df = 8, p = .652.

3.Cox and Snell R^2 = .104; Nagelkerke R^2 = .203; H-L Chi-squared = 6.206, df = 8, p = .624.

4.Cox and Snell R^2 = .105; Nagelkerke R^2 = .256; H-L Chi-squared = 2.089, df = 8, p = .978.

5.Cox and Snell R^2 = .030; Nagelkerke R^2 = .092; H-L Chi-squared = 11.049, df = 8, p = .199.

6.Cox and Snell R^2 = .106; Nagelkerke R^2 = .206; H-L Chi-squared = 3.717, df = 8, p = .882.

[a]All urban-bound migrants include both rural-to-urban migrants who stayed at destination and rural-urban-rural return migrants.

[b]Goodness-of-fit statistics:

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Coefficients on the effect of migration status between 2005 and 2007 on physical health status (PCS) using fixed-effects regression (standard errors are shown in parentheses)

Covariates	Model 1 (*N* = 2,509)	Model 2 (*N* = 2,509)	Model 3 (*N* = 292)
Migration Status			
All urban-bound migrants	0.388 (0.554)	—	—
Rural-to-urban migrants	—	0.434 (0.695)	0.125 (0.987)
Rural-urban-rural return migrants	—	0.322 (0.830)	ref.
Rural comparison group	ref.	ref.	—
Married (ref. = single)	–0.644 (0.789)	–0.647 (0.790)	–2.385 (1.622)
Widowed/Divorced/Separated (ref. = single)	0.093 (1.143)	0.089 (1.144)	1.191 (2.735)
Primary Education (ref. = no education)	0.730 (1.687)	0.735 (1.688)	–4.617 (5.709)
Secondary Education (ref. = no education)	1.142 (1.940)	1.148 (1.941)	–4.207 (6.046)
Higher Education (ref. = no education)	0.206 (2.164)	0.201 (2.165)	–5.652 (6.204)
Looking for a Job (ref. = not working)	–0.227 (1.258)	–0.223 (1.259)	–0.375 (2.726)
Working (ref. = not working)	–0.571 (0.415)	–0.572 (0.415)	–1.015 (1.421)
Student (ref. = not working)	0.079 (1.073)	0.082 (1.073)	–1.187 (1.869)
Moved Within Kanchanaburi Study Sites[a] (ref. = did not move/urban-bound move)	0.481 (0.729)	0.481 (0.729)	—
Year (ref. = 2005)	–0.528** (0.196)	–0.528** (0.196)	0.042 (0.779)
Constant	53.412*** (1.750)	53.410*** (1.750)	59.624*** (5.679)

Note: Hausman statistical tests: Model 1 chi-squared = 20.67, p =.037; Model 2 chi-squared = 25.46, p = .013; Model 3 chi-squared = 7.80, p = .649.

[a] This variable controls for movement among the rural comparison group with the Kanchanaburi study sites.

** $p < .01$

*** $p < .001$

Table 5

Coefficients on the effect of migration status between 2005 and 2007 on mental health status (MCS) using fixed-effects regression (standard errors are shown in parentheses)

Covariates	Model 1 (*N* = 2,509)	Model 2 (*N* = 2,509)	Model 3 (*N* = 292)
Migration Status			
All urban-bound migrants	1.167† (0.701)	—	—
Rural-to-urban migrants	—	2.154* (0.879)	2.557† (1.321)
Rural-urban-rural return migrants	—	–0.286 (1.050)	ref.
Rural comparison group	ref.	ref.	—
Married (ref. = single)	–0.401 (0.999)	–0.474 (0.999)	–0.558 (2.172)
Widowed/divorced/separated (ref. = single	–2.108 (1.446)	–2.205 (1.446)	2.137 (3.663)
Primary Education (ref. = no education)	–2.305 (2.135)	–2.202 (2.135)	–6.777 (7.644)
Secondary Education (ref. = no education)	–2.387 (2.456)	–2.270 (2.455)	–7.381 (8.095)
Higher Education (ref. = no education)	–2.182 (2.738)	–2.314 (2.738)	–9.290 (8.307)
Looking for a Job (ref. = not working)	3.028† (1.592)	3.126* (1.592)	5.843 (3.650)
Working (ref. = not working)	0.219 (0.525)	0.201 (0.525)	1.197 (1.902)
Student (ref. = not working)	–0.123 (1.357)	–0.062 (1.357)	0.863 (2.502)
Moved Within Kanchanaburi Study Sites[a] (ref. = did not move/urban-bound move)	–0.285 (0.923)	–0.281 (0.922)	—
Year (ref. = 2005)	1.176*** (0.249)	1.184*** (0.248)	1.242 (1.043)
Constant	49.538*** (2.215)	49.510*** (2.214)	52.177*** (7.601)

Notes: Interaction effects between sex and migration status were not significant, so interaction terms are excluded from these models. When the models are analyzed separately by sex, the positive effect of rural-to-urban migration on mental health status is significant for female urban-bound migrants in Model 1 and female migrants who stayed at destination in Model 2. The effects of migration on mental health status are not significant for males (Nauman 2013). Hausman statistical tests: Model 1 chi-squared = 29.94, $p = .002$; Model 2 chi-squared = 12.14, $p = .434$; Model 3 chi-squared = 2.75, $p = .987$

**$p < .01$

[a] This variable controls for movement among the rural comparison group with the Kanchanaburi study sites.

†$p < .10$

*$p < .05$

***$p < .001$

Table 6

Coefficients on the association between duration of stay in urban destinations and mental health status measured at T_1 (in 2007) (standard errors are shown in parentheses)

Covariates	Mental Health (MCS at T_1) (N = 179)	Mental Health (MCS at T_1) (N = 179)
Duration of Stay in Urban Destination (continuous, in months)	0.172* (0.081)	0.161† (0.086)
Mental Health Status at T_0 (in 2005) (continuous)	0.273*** (0.061)	0.270*** (0.064)
Control Variables		
Sex (ref. = female)		–0.188 (1.242)
Age at T_1 (continuous)		0.178 (0.233)
Married at T_1 (ref. = single or widowed/divorced/separated)		–2.565 (1.552)
Working at T_1 (ref. = not working)		–1.686 (2.667)
Studying at T_1 (ref. = not working)		–0.723 (3.206)
Primary education at T_1 (ref. = no education)		–2.182 (6.028)
Secondary education at T_1 (ref. = no education)		–3.120 (5.993)
Higher education at T_1 (ref. = no education)		–4.506 (6.203)
Constant	35.047*** (3.278)	37.226*** (9.509)
Goodness-of-Fit (R^2)	.113	.133

Note: The quadratic term for duration of stay was not significant and is therefore not included in the models.

$^{\dagger}p < .10$

$^{*}p < .05$

$^{***}p < .001$

Table 7

Sample characteristics at T_1 (in 2007) for rural-to-urban migrants, rural-urban-rural return migrants, and longer-term urban residents in the destination areas: Means (standard deviations) or percentages (*n*)

Characteristics	Rural-to-Urban Migrants (*N* = 179)	Rural-Urban-Rural Return Migrants (*N* = 113)	Longer-Term Urban Residents (*N* = 252)
Age (mean years: 19-31)	23.21 (3.14)***, *n.s.*	24.84 (3.67)***	23.26 (3.28)
Sex (%)			
Male	48.6 (87)*, *n.s.*	59.3 (67)*	48.0 (121)
Female	51.4 (92)	40.7 (46)	52.0 (131)
Marital Status (%)			
Single	50.8 (91)**, *	35.4 (40)***	61.1 (154)
Married	46.4 (83)*, *	61.1 (69)***	36.9 (93)
Widowed/divorced/separated	2.8 (5)*n.s.*, *n.s.*	3.4 (4)*n.s.*	2.0 (5)
Occupation (%)			
Professional	12.3 (22)†, *n.s.*	6.2 (7)*	13.9 (35)
Skilled	46.9 (84)*n.s.*, *n.s.*	45.1 (51)*n.s.*	45.2 (114)
Manual labor	7.3 (13)***, *n.s.*	27.4 (31)***	9.9 (25)
Student	27.4 (49)***, *n.s.*	5.3 (6)***	22.6 (57)
Not working	6.1 (H)**, *n.s.*	15.9 (18)*	8.3 (21)
Education (%)			
None	1.1 (2)*, *n.s.*	5.3 (6)*	0.8 (2)
Primary (1-6 yrs)	20.7 (37)***, **	41.6 (47)***	9.9 (25)
Secondary (7-12 yrs)	41.3 (74)*n.s.*, *n.s.*	39.8 (45)*n.s.*	37.3 (94)
Undergraduate/masters (13+ years)	36.9 (66)***, **	13.3 (15)***	52.0 (131)
Previous Migration Experience (ever migrated before 2005 for the migrant groups) (%)	72.1 (129)**, ***	85.0 (96)*n.s.*	87.7 (221)

n.s $p > .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 8

Coefficients on the association between migration status and health outcomes measured at T_1 (in 2007), controlling for sociodemographic characteristics (standard errors are shown in parentheses)

Covariates	Physical Health (PCS) (N = 544)	Mental Health (MCS) (N = 544)
Migration Status		
Rural-to-urban migrants (ref. = urban comparison group)	2.937*** (0.914)	2.802** (0.963)
Rural-urban-rural return migrants (ref. = urban comparison group)	–0.670 (1.204)	0.389 (1.183)
Interaction Terms		
Rural-to-urban migrant × Male	–2.721* (1.303)	—[a]
Return migrant × Male	0.347 (1.5 54)	—
Control Variables		
Sex (ref. = female)	2.807*** (0.856)	0.051 (0.876)
Age at T_1 (continuous)	0.004 (0.097)	0.284* (0.139)
Single at T_1 (ref. = married)	0.236 (0.724)	1.019 (1.040)
Widowed/divorced/separated at T_1	0.667 (1.828)	1.821 (2.639)
Working at T_1 (ref. = not working)	0.171 (1.233)	–0.971 (1.755)
Studying at T_1 (ref. = not working)	1.659 (1.490)	0.280 (2.127)
Looking for a job at T_1 (ref. = not working)	0.633 (2.186)	1.793 (3.147)
Primary education at T_1 (ref. = no education)	–4.711* (2.213)	–2.285 (3.185)
Secondary education at T_1 (ref. = no education)	–1.052† (2.199)	–2.190 (3.168)
Higher education at T_1 (ref. = no education)	–4.567* (2.280)	–2.846 (3.289)
Constant	54.346*** (3.490)	43.327*** (4.916)

Notes: Previous migration experience since birth (and before 2005 for the migrant groups) was not significantly associated with physical or mental health status in 2007 and therefore is not included in the final models.

Goodness-of-fit for physical health (PCS): R^2 = .058, adjusted R^2 = .034. Goodness-of-fit for mental health (MCS): R^2 = .029, adjusted R^2 = .007.

[a] There is no significant interaction in the mental health model.

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$