



Cohort Profile

Cohort Profile: Ifanadiana Health Outcomes and Prosperity longitudinal Evaluation (IHOPE)

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Why was the cohort set up?

The Ifanadiana Health Outcomes and Prosperity longitudinal Evaluation (IHOPE) cohort was set up to fill a gap in health system-strengthening implementation science, and was designed to improve the standards for impact evaluation of health system strengthening (HSS) interventions.¹ IHOPE was established in 2014, at baseline of a new HSS intervention designed to establish a model health district in a rural area of Madagascar, which is one of the poorest countries with the lowest per capita health spending in the world.² Weak health systems foster illness, death and loss of human capital that undermines economic development.^{3–5} Jamison and colleagues⁶ assert that 10 million deaths worldwide could be averted annually by 2035 with existing technologies and known services if all are adequately implemented. Many developing countries, including Madagascar, actually have policies that are aligned with international standards of health care but lack the resources and adequate experience required to apply them effectively. A chronic challenge in global health is the limited effectiveness of vertical programmes when implemented without broader systems of

support. Consequently, over the past decade, attention has shifted to more formalized horizontal and diagonal frameworks of health system-strengthening with a special emphasis on integrated primary health care.^{7–10} The World Health Organization (WHO) HSS framework involves six building blocks: service delivery, health workforce, health information systems, medicines and supplies, financing, and leadership and governance.⁵ Strengthening these building blocks has the potential to create lasting health change in impoverished settings and help build resilient and equitable systems.

Despite multiple HSS efforts over the past decade, there remains a dearth of clear evidence of the process through which broad-based health interventions are implemented and how those, in turn, can change population-level health.¹¹ The evidence of the impacts of HSS interventions tend to be of three types: multivariate statistical analysis of national policies based on country-level data, sometimes with significant results but with substantial confounders;^{12–14} analysis of isolated interventions [as with randomized controlled trials (RCTs) of vertical programmes] with clear measurable effects on individuals, but without

population-level impacts;^{15–17} and analyses focused on measurement of process or input indicators but not population-level impacts on broad health indicators.^{17–19} Much of the research on HSS includes evaluation of routine health system data combined with periodic cross-sectional surveys at the population level.²⁰ However, such approaches can mask basic inequalities (i.e. geographical or socioeconomic) or overestimate the reach of a programme and may hide individual effects when these are too small to detect at the population level.^{11,21–23} Furthermore, it is often difficult to attribute the change in population outcomes (or the lack thereof) to specific health care interventions rather than the HSS intervention as a whole. This can prevent the scale-up of the most successful components of an intervention to other areas.²⁴

The IHOPE cohort is designed to help fill this gap in implementation science. This cohort study allows for evaluating an initiative that strengthens all six of the WHO building blocks of HSS at all levels of the health system in a well-defined geographic area of a government district. The intervention, implemented via partnership between the Ministry of Health and the health care NGO PIVOT, combines horizontal and vertical programmes across all levels of care (community health, health center, and hospital) in the public health system of Ifanadiana District in southeastern Madagascar. The health system strengthening programme currently includes one-half of a district population of approximately 200 000 people, with some activities spanning the whole district. In brief, it includes infrastructure renovations, staffing and equipment provision; support to improve procurement systems; the initiation of an ambulance network; support to strengthen the community health system; removal of user fees and social support to patients; trainings and frequent supervision of health staff; reinforced monitoring and evaluation including strengthening of the Health Management Information System; and implementation of vertical programmes such as malnutrition, Integrated Management of Childhood Illness (IMCI) and tuberculosis.¹ Over time, further programmes will be rolled out district-wide, and the geographical reach of the intervention will be expanded until the whole district is receiving all programmes by 2022, which can then be used as a model for the country. The process of national scale-up would necessarily rely on partnerships between the Madagascar government, multilateral institutions and non-governmental partners, where PIVOT may play a dual role as an adviser and implementing partner to the government. The key to transitioning to National Scale-Up is integrating with the Ministry of health (MoH) from the start, and producing evidence that multiple vertical programmes can be locally integrated through strengthened health systems at the point of care.

The longitudinal follow-up of 1600 households across Ifanadiana district (about 8000–9000 individuals) in the IHOPE cohort will allow for measurement of differences over time in: preventive and care-seeking behaviours; prevalence of malnutrition and illness; mortality rates in adults and children; and socioeconomic conditions. We will be able to compare the intervention's initial catchment area with the rest of the district, and associate the roll-out of specific services with improvements in health indicators over time. Survey instruments used in the IHOPE cohort are based on those used in the national Demographic and Health Survey (DHS), thus allowing comparisons with the rest of the country (as well as with most other developing countries) every 5 years. By following the same individuals over time, we will be able to assess the impact on individuals and households, capturing unobserved heterogeneity (or fixed effects) that standard cross-sectional studies necessarily miss.

Who is in the cohort?

The IHOPE cohort comprises a representative sample of Ifanadiana District population, in south-eastern Madagascar. The sample of 1600 households was selected using a two-stage cluster sampling scheme involving 80 clusters and two strata (PIVOT's initial and future catchment areas). The study is an open cohort: households that decline to participate in some years are replaced with new households from the same geographical cluster, and individuals within the households also may enter (via birth or moving into the household) and leave the cohort (via death, moving away or refusal). Eligibility criteria for interview were based on DHS standard criteria and included individuals of reproductive age (defined as age range 15–49 for women, 15–59 for men) who were *de facto* residents of the household (usual members or had spent the previous night in the household). Information about other members of the household was provided during the interviews. The baseline population consisted of 8310 individuals, including 1755 children under age 5, 1774 women and 1863 men eligible for interview. Enrollment data are available on 10 508 individuals from a combination of two waves of data collection. [Table 1](#) summarizes demographic and health characteristics at baseline for Wave 1, Wave 2 and replacements.

How often have they been followed up?

The first two waves were conducted in 2014 and 2016, and a third wave is in preparation for 2018. We will conduct yearly follow-up surveys after 2018 for a minimum of 5 years (more, if funding becomes available). The IHOPE

Cohort has been successfully established, with good retention rates at 2 years (Figure 1). Of 1600 households approached in the baseline survey, 1522 (95.1%) agreed to participate. Of these 1522, 1390 (91.3%) were available and agreed to participate in the 2016 follow-up survey. An additional 124 households were added to the IHOPE in Wave 2, using a predefined list of random households from the master list of the same clusters, for a total of 1514 households in wave 2. Retention strategies involve small thank-you gifts to the participating households (for example, thread or small packages of soap) and villages (for example, ink pads for village leaders), as well as repeated community sensitization and timing of fieldwork to avoid holidays and important agricultural periods. Figure 1 shows a flow chart of the IHOPE enrollment results.

What has been measured?

We collect data at both individual and household levels (Table 2). Interview data are collected through interviews with the adult residents of the selected households. Mothers or primary caregivers provide the responses for children under the age of 15 in the household. Anthropometric measurements have been collected on all children at every wave and on adults at baseline or study entry, using the standardized methods utilized by DHS. Data collection forms have been adapted from pre-existing survey tools, notably the Madagascar DHS, the Multiple Indicator Cluster Survey (MICS) 4 and the Integrated Household Living Standards Survey, all of which have been successfully conducted in the Malagasy language by the Institute of Statistics (INSTAT) in the past.

As all of the above-mentioned questionnaires are designed for cross-sectional surveys, we adapted some of the questions for longitudinal purposes, including determining participants' assessments of changes to their health and economic status since the year prior, and the subject's reasons for these changes, such as found in the Young Lives studies.²⁵ We anticipate collecting biologic samples, including blood (for malaria, anemia) and fecal samples (for enteric pathogens) in future waves.

What has been found? Key findings and publications

Several studies have been published using information collected at the 2014 baseline,^{1,18,26,27} and the first impact evaluation of the intervention using longitudinal population data is forthcoming. Links to publications are posted on the PIVOT website [<http://pivotworks.org/impact/publications>] as they become available. Key findings to date are summarized in the following paragraphs.

Baseline analyses showed that maternal and under-5 mortality rates in Ifanadiana District in 2014 were more than double the national estimates for Madagascar, at 1044 deaths/100 000 women and 145 deaths/1000 live births, respectively.²⁷ High mortality rates were seen in parallel with widespread poverty, high morbidity and low access to care at health facilities. For instance, only 20% of deliveries were attended by a doctor or nurse/midwife. Furthermore, 87% of households and 58% of children under 5 reported illness in the weeks preceding the survey. Of those, less than a third sought treatment at a health facility. The rate of extreme poverty in Ifanadiana was estimated at 73%, with more than 80% of the population relying on subsistence agriculture as their primary occupation. These insights led to a detailed study on the barriers associated with health care access in the district, and on the impact of two user-fee exemption programmes in the district.¹⁸

Care-seeking behaviour at baseline was strongly correlated with socioeconomic status and distance from health facilities, even when controlling for demographic factors and illness severity.¹⁸ User fees were thus a strong barrier to care. To evaluate the impact of the fee-exemption programme, we complemented survey data with a 3-year utilization time series at all 19 health centres in Ifanadiana. Fee exemptions for targeted medicines and services were associated with increases in use by 65% for all patients, 52% for children under 5 and over 25% for maternal consultations. In addition, it was found that every additional health worker at the facility was associated with a 10% increase in utilization, which provided support to a recent programme of joint PIVOT-MoH hires to bring human resources up to government norms.

Socioeconomic and health information at baseline, in combination with a separate diagnostic data collection on pathogen prevalence in humans and livestock, have also allowed for parameterization of novel mathematical models that estimate the economic burden of animal diseases on poor households in Ifanadiana.²⁶ It was estimated that households may lose between 10–25% of their monthly income due to the cumulative effects of disease in livestock. These results revealed the need for an improved control of livestock diseases.

Using a combination of longitudinal survey data and routine health system data, other ongoing studies are focusing on: factors associated with malnutrition in Ifanadiana²⁸ and the impact of PIVOT's malnutrition programme in the catchment area; the evolution of effective coverage and the content of care across different levels of care (e.g. community, health facility) in the catchment area and the rest of the district;²⁹ and the spatio-temporal utilization trends and characterization of geographical barriers over time.

Table 1. IHOPE demographic and health characteristics, overall and by wave

Variable	Total households enrolled in either 2014 or 2016	Households retained in both 2014 and 2016	Households present in 2014, but not participating in 2016 (numbers from 2014)	Households newly enrolled in 2016
Household characteristics				
Total number of households	1688	1348	174	166
Mean household size (<i>n</i> individuals)	5.2	5.6	4.9	5.5
Percentage of households with access to improved sanitation facilities (toilets, composting toilets or latrines)	2.9	1.9	4	1.8
Percentage of households with access to improved drinking water (protected water source, public tap or supply, bottled water)	14.9	10.9	17.8	19.3
Percentage of households with electricity	9.3	11	20.4	15.1
Percentage of households in the poorest quintile	50.1	18.4	13.8	17.5
Percentage of households with mosquito bed nets	94.8	95.1	97.6	93.7
	Total individuals enrolled in either 2014 or 2016	Individuals retained in both 2014 and 2016	Individuals present in 2014, but not participating in 2016 (ns from 2014)	Individuals newly enrolled in 2016
Individual characteristics				
Total number of individuals	10 509	6329	1972	2208 ^a
Male sex: <i>n</i> (%)	5184 (49.3)	3168 (50.0)	922 (46.7)	1094 (49.5)
Age group, in years: <i>n</i> (%)				
0–5	2574 (24.5)	1354 (21.4)	399 (20.2)	821 (37.1)
6–14	2997 (28.5)	1963 (31.0)	486 (24.6)	548 (24.8)
15–24	1925 (18.3)	987 (15.6)	558 (28.3)	380 (17.2)
25–34	1079 (10.3)	695 (11.0)	225 (11.4)	159 (7.2)
35–44	828 (7.9)	577 (9.1)	117 (5.9)	134 (6.1)
45–60	790 (7.5)	571 (9.0)	111 (5.6)	108 (4.9)
60+	269 (2.6)	158 (2.5)	62 (3.1)	49 (2.2)
Missing	47 (0.45)	24 (0.4)	14 (0.7)	9 (0.4)
Marital status of married/living as married (<i>n</i> = 4891 over age 15): <i>n</i> (%)	2873 (58.7)	2009 (69.4)	456 (41.9)	431 (51.4)

^aIncludes new births and new residents in old households, as well as new households.

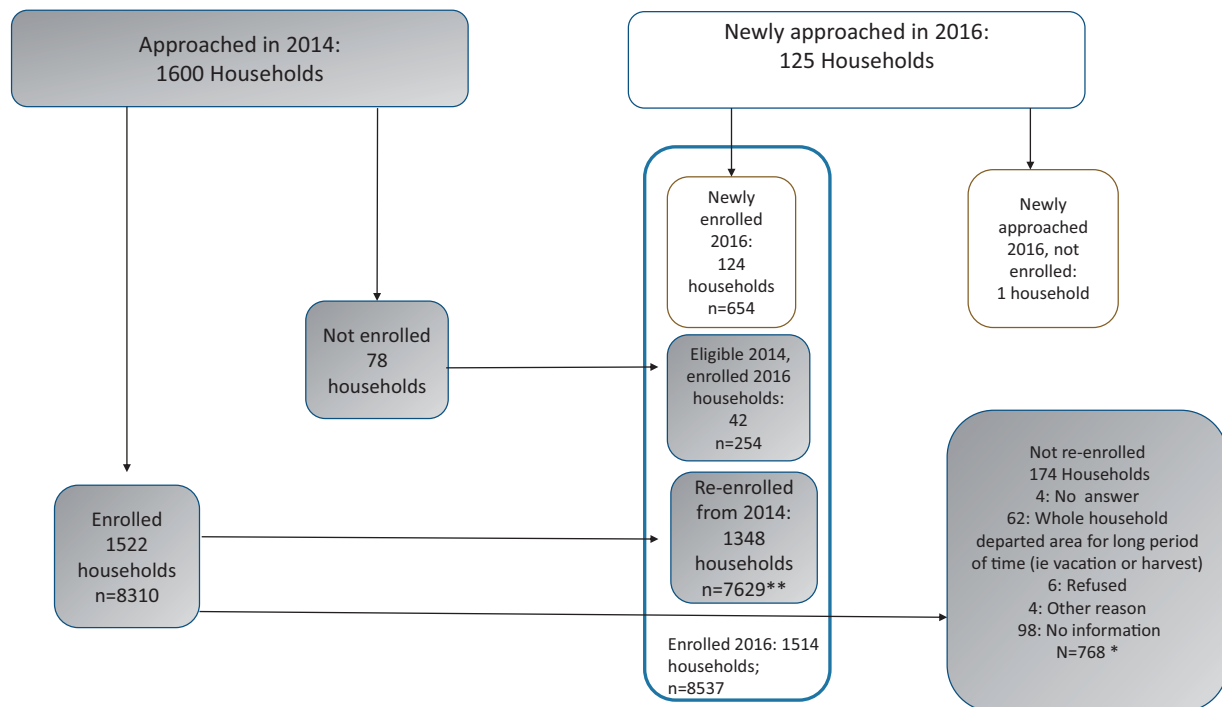


Figure 1. IHOPE cohort enrollment flow chart, 2014–16. Altogether, 1725 households were approached for enrollment over the first 2 years of the study; 1522 households enrolled in 2014 and 1514 households in 2016. No individual numbers are available for households that did not participate. Of households that enrolled in 2014 but did not re-enroll in 2016, $n = 768$ as of 2014; the n in those households from 2016 was unknown. Of 8537 residents enrolled in 2016, 7542 re-enrolled from 2014, with 87 new members of the 2014 households enrolling in 2016.

Table 2. Survey questionnaires and information included for IHOPE cohort

Measurements	Variables
Household questionnaire	HH composition: household size, genders, ages and relationships among household members Socioeconomic status: level of education of household members, details of work activity, employment, income (including in-kind contributions); structure and physical condition of the house; type and condition of latrine or toilet; household durable assets Injuries or illnesses in past 30 days and work-time lost to illness Mosquito bed net ownership and use Household perception of life conditions—changes from latest visit in health or economic well-being ^a
Women's questionnaire (ages 15–59 eligible)	Education status; modules on reproductive history and care-seeking behaviours for reproductive health; fertility preferences; general health and risk factors; women's status; children's health, child development and care-seeking for child illness; sibling mortality
Men's questionnaire (ages 15–59 eligible)	Education status; modules on reproductive history; fertility preferences; general health; women's status; sibling mortality
Anthropometrics (all HH members)	Height (or length in the case of newborns), weight

^aQuestions only asked during follow-up survey.

Main strengths and weaknesses

Main strengths of the IHOPE cohort include: (i) use of standard survey instruments and national data collection systems; (ii) establishment of a true baseline (before initiation of HSS activities); and (iii) enrollment of households within and outside the initial intervention area. The survey instrument and study design are based primarily on the DHS, and survey teams consisted of experienced national

professionals who carry out every major national survey in the country. These data can be compared directly with national and international trends. Response rates for the baseline survey were extremely high (95%+) and revisit rates for the second wave were also above 90%. Another strength of the cohort is that it takes place in an impoverished rural African setting. To our knowledge, this is the only long-term longitudinal cohort study of health and

economic conditions in Madagascar aiming to assess both individual-level and district-level impacts of a public sector health system-strengthening programme.

This cohort does have some weaknesses: as a DHS-style survey, we are not conducting interviews with people outside the reproductive years of age, and some important economic and health indicators among older participants or children 5–15 years old may be missed. Additionally, although the IHOPE Cohort will be assessing differences in outcomes based on whether participants are in the initial or later catchment areas, the health system-strengthening programme is not randomly allocated. The baseline data demonstrated some socioeconomic differences in the initial and later catchment areas. Also, although there are many similarities in socioeconomic status between the replacement households and those who were lost in wave 2, some differences between these two groups do exist.

Can I get hold of the data? Where can I find out more?

The data from the IHOPE cohort study are not yet publicly available; however, it is anticipated that they will be made available to researchers and collaborators in accordance with PIVOT's and Madagascar INSTAT's data-sharing policies. Priority for access to the data will be given to Malagasy researchers and students or researchers collaborating with Malagasy students. More information about possible collaborations with PIVOT on the use of the data can be found by contacting the study's principal investigators, Dr Ann C Miller or Dr Andres Garchitorena, at [research@pivotworks.org].

IHOPE profile in a nutshell

- IHOPE is a prospective observational cohort in households in a rural district in Madagascar, which is the focus of a health system-strengthening project.
- IHOPE investigates the influences over time on individual and population health, development and economic well-being in the context of expanding health system improvements.
- The IHOPE cohort comprises a representative sample of Ifanadiana District population. Households were selected using a two-stage cluster sampling scheme involving 80 clusters and two strata.
- Two waves of household interview data collection took place between 2014 and 2016; baseline [$n = 8310$ individuals in 1522 households, including 1755 children under age 5, 1774 women (ages 15–49) and

1863 men (ages 15–59)] and Wave 2 [$n = 8537$ individuals in 1514 households (7629 from 1348 original households plus 908 in 166 replacement households)].

- Data include sociodemographics, anthropometrics, health, care-seeking, child development and economics (including expenditures, assets and income). We anticipate collecting biological samples including blood (for malaria, anaemia) and fecal samples (for enteric pathogens) in the future.
- IHOPE is a collaboration between the health care non-governmental organization (NGO) PIVOT, the Madagascar National Institute of Statistics (INSTAT) and the Ministry of Health.
- IHOPE cohort data will be available in accordance with PIVOT's and INSTAT's data-sharing policies. Malagasy or researchers collaborating with Malagasy students will have priority for access to the data.

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