5-1-2023

Cost-effectiveness analysis for integrated social and behavior change programming by the Resilience in the Sahel Enhanced II program in the Maradi and Zinder regions of Niger

Avenir Health

TECHNICAL REPORT

Cost-effectiveness Analysis for Integrated Social and Behavior Change Programming by the Resilience in the Sahel Enhanced II Program in the Maradi and Zinder Regions of Niger

MAY 2023

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Acknowledgments

We would like to say thank you to the Resilience Food Security Activities in Niger which include Hamzari (led by Care), Girma (led by Catholic Relief Services), and Wadata (led by Save the Children) for their collaboration in this activity.

Breakthrough RESEARCH is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of cooperative agreement no. AID-OAA-A-17-00018. The contents of this document are the sole responsibility of the Breakthrough RESEARCH and Population Council and do not necessarily reflect the views of USAID or the United States Government.

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Suggested Citation

Avenir Health. 2021. "Cost-effectiveness analysis for integrated social and behavior change programming by the Resilience in the Sahel Enhanced II program in the Maradi and Zinder regions of Niger," *Breakthrough RESEARCH Technical Report*. Washington, DC: Population Council.

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Acronyms

ANC	antenatal care
CCP	Johns Hopkins University Center for Communication Programs
DALY	disability-adjusted life year
FP	family planning
GDP	gross domestic product
ICER	incremental cost-effectiveness ratio
IPC	interpersonal communication
LiST	Lives Saved Tool
mCPR	modern contraceptive prevalence
MNCH	maternal, neonatal and child health
MWRA	married/in union women of reproductive age
RFSA	Resilience Food Security Assistance
RISE II	Resilience in the Sahell II
SBC	social and behavior change
USAID	United States Agency for International Development
USD	United States dollar
WASH	water, sanitation, and hygiene
YLD	years of life lived with disability
YLL	years of life lost to death

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EXECUTIVE SUMMARY

Background

The United States Agency for International Development (USAID) funds programs that work with the government and partners to improve health and development outcomes in Niger, including the Resilience in the Sahel II (RISE II) initiative. RISE II builds on prior efforts to improve priority health behaviors related to maternal, newborn and child health (MNCH), family planning (FP), nutrition, and water, sanitation and hygiene (WASH) through a multi-sectoral integrated social and behavior change (SBC) approach in the Maradi and Zinder regions of Niger (USAID 2018). The Breakthrough ACTION project is supporting the RISE II initiative via capacity building, leveraging their expertise in SBC design, and supporting the launch of a national campaign. Three Resilience Food Security Assistance (RFSA) partners are leading the implementation of SBC activities, including radio programming, interpersonal communication (IPC), community awareness raising and community engagement interventions, and provider behavior change initiatives.

Breakthrough RESEARCH conducted an evaluation of the RISE II initiative by examining the SBC costs and the impact of SBC activities on priority health outcomes. The impact analysis utilizes three repeated cross-sectional surveys: a baseline survey in April and May 2021, a midline survey in April and May 2022, and a final survey scheduled to be available in March 2023. This report combines the expenditures from the project initiation through April 2022 to match the timeframe of the total costs with the impact data collected at midline. Using these inputs, the primary research question addressed in this analysis is *what is the cost-effectiveness of RISE II at midline?* A second research question is *what increase in health outcomes is necessary to yield cost-effective results by the end of programming activities?*

Methods

To evaluate the cost-effectiveness of RISE II SBC interventions, it is necessary to calculate the **incremental cost-effectiveness ratio**, or ICER. An ICER examines the total costs associated with SBC interventions divided by the total impact following three main steps: 1) estimate the impact of SBC interventions on priority health outcomes, 2) estimate the SBC-related costs, and 3) calculate the ICER.

The baseline and midline surveys are used to assess impact at midline. While the RISE II initiative is multisectoral and has more components than just SBC, including agricultural and microfinancing, the health outcomes are expected to be largely linked to the SBC programming. Because the SBC interventions cross multiple health areas, a common impact measure is needed. As such, a linear deterministic causal model called the **Lives Saved Tool (LiST)** was used to examine how changes in population coverage of specific interventions translate into the number of lives saved over a specified time period based on changes in priority health outcomes: modern contraceptive prevalence, antenatal care attendance, facility-based births, and handwashing. LiST scenarios were developed to estimate the number of lives saved attributable to the RISE II program at midline (2022), which were then translated into disability-adjusted life years (DALYs) averted using the **GBD Results Tool** for Niger. Two further sets of hypothetical scenarios were also examined: 1) a **25% improvement** scenario explored what the impact would be if the outcomes in the intervention group increased by 25% from the 2022 value by 2025 compared to a control group in which the outcomes remained constant at their 2022 levels through 2025 and 2) **25% + breastfeeding** scenario examined the same hypothetical 25% increase between 2022 and 2025 for the intervention area but also included increases in breastfeeding outcomes, which were not adequately measured in the Breakthrough RESEARCH surveys, although SBC interventions were provided in these areas.

The first phase of SBC expenditures covered project initiation through September 2021 and were summarized in a prior Breakthrough RESEARCH report. The second phase captured SBC expenditures from October 2021 through September 2022. When aggregating expenditures across time periods, the total expenditures were adjusted to 2022 United States dollars using the **United States gross domestic product (GDP)** deflator. Since implementation of SBC activities began gradually in mid-2020, the prior start-up costs in 2019 and the first half of 2020 were amortized over the life of RISE II to 2025. Total expenditures were calculated at midline (April 2022). To estimate SBC expenditures to 2025 for the hypothetical

scenarios, the monthly average spend from January 2021 to September 2022 was used to project expenditures going forward through June 2025 at a constant rate. Service delivery costs associated with changes in the behavioral health outcomes were also estimated using the LiST costing module.

Once the impacts and costs were obtained, the ICER was calculated. For the RISE II study, the total costs are divided by the total DALYs averted to estimate the cost per DALY averted. This ICER was then compared to Niger's GDP per capita to assess cost-effectiveness. According to World Health Organization's guidelines, health interventions with a cost per DALY averted that are less than one times the GDP per capita are considered "highly cost-effective" and those between one and three times the GDP per capita are "cost-effective". To ensure comparability with the costs, the GDP per capita was adjusted to 2022 United States dollar using the US GDP deflator, resulting in a value of $631.93. As such, the cost per DALY averted needs to be below $632 for the SBC investments to be considered "highly cost-effective" and below $1,896 to be "cost-effective".

Results

At midline, an estimated four lives were saved due to the RISE II initiative, yielding 122 DALYs averted. When combined with the estimated costs of approximately $5.7 million at midline, the resulting cost per DALY averted is $47,005 and thus over the threshold of $1,896 and deemed not cost-effective.

Far more DALYs averted are generated in the two hypothetical scenarios that extend to 2025. The 25% improvement scenario yields a total of 4,835 DALYs averted and the 25% + breastfeeding scenario generates 12,131 DALYs averted. When combined with an estimated SBC cost of $19.9 million by 2025, the cost per DALY averted is $4,111 for the 25% improvement scenario and $1,597 for the 25% + breastfeeding scenario. While the 25% improvement scenario is still above the cost-effective threshold, the 25% + breastfeeding scenario is below the threshold and therefore considered cost-effective.

Discussion

This study is one of the first to examine the cost-effectiveness of integrated SBC programming. We present three key findings that shed light on whether SBC interventions are or could be cost-effective. First, **the ICER using the results from the midline scenario of $47,005 per DALY averted is not cost-effective**. Given the brief time span between the baseline and the midline, this result is not surprising as more time is typically needed for SBC programming to shift underlying intermediate determinants, which can then later be detectable as changes in health behavioral outcomes. For these reasons, looking ahead to future studies, one recommendation is that researchers use project midline to explore other relevant costing questions, but not focus on midline cost-effectiveness.

A second major finding from this analysis is that **cost-effectiveness of the RISE II SBC program is achievable if substantial positive changes in health outcomes occur by project endline**. The 25% + breastfeeding scenario is below the cost-effective threshold for Niger. While a 25% increase in outcomes due to SBC interventions is substantial, it is not beyond the bounds of what is feasible. A similar survey of the outcomes in 2025 would reveal whether this level of change occurred for the key outcomes in this analysis.

The third key finding is the **importance of capturing all relevant outcomes in an impact measure for cost-effectiveness analysis**. In this projection, the inclusion of the breastfeeding outcomes is critical for achieving the cost-effectiveness threshold. For integrated SBC overall, missing the inclusion of a priority health behavior from the impact denominator is problematic for the analysis because it under-estimates important health gains. This is particularly challenging for multisectoral programs like RISE II, where improvements in agricultural yields and reducing early marriage have known economic benefits but these benefits do not map to health outcomes that can be mapped into DALYs averted. For integrated SBC projects that cross different sectors, other approaches such as a benefit cost-ratio analysis, will likely yield more complete and thus more favorable results, but they are also more difficult to conduct.

As with all modeling studies, the analysis relies on various data inputs and assumptions in assessing both the impacts and the SBC costs. This analysis also assumes that the changes in the health indicators are due to SBC programming and not the other RISE II activities, such as direct food aid and agricultural support. Despite these limitations, while a one-year time frame is premature for yielding useful cost-effectiveness results, the hypothetical scenarios included in this analysis indicate that if substantial gains are made in key health outcomes,

cost-effectiveness could be achieved by project end, although these scenarios are, of course, speculative. Looking forward, more research is needed to examine the cost-effectiveness of integrated SBC and further exploration on what types of integrated programming are most cost-effective.

BACKGROUND

Niger faces multiple health and development challenges, including high rates of malnutrition, mortality, fertility, and chronic food insecurity (USAID 2022, UNICEF 2018). Additionally, a historical pattern of severe droughts and recurring environmental shocks and stressors have undermined development progress (USAID 2018). In response, the United States Agency for International Development (USAID) funds programs that work with the government and partners to improve health and development outcomes in Niger, including the Resilience in the Sahel II (RISE II) initiative, which aims through multisectoral programming to build on prior efforts to improve priority health behaviors related to maternal, newborn and child health (MNCH), family planning (FP), nutrition, and water, sanitation and hygiene (WASH) through an integrated social and behavior change (SBC) approach in the Maradi and Zinder regions of Niger (USAID 2018).

The Breakthrough ACTION project, led by Johns Hopkins University Center for Communication Programs (CCP), with partners Save the Children, ideas42 and Viamo, is supporting the RISE II initiative via capacity building, leveraging their expertise in SBC design, and supporting the launch of the *Garkuwar Al'Umma* campaign (which means "Shield of the Community" in Hausa). *Garkuwar Al'Umma*, launched in December 2022, is a nationwide campaign that aims to unify and promote a range of health behaviors under one flagship brand. Three Resilience Food Security Assistance (RFSA) partners are leading the implementation of SBC activities, with the Hamzari project led by CARE, the Girma project led by Catholic Relief Services, and the Wadata project led by Save the Children. Each of the RFSAs are implementing radio programming, interpersonal communication (IPC), and community awareness raising and community engagement interventions. Additionally, Girma conducts text messaging around nutrition and health, while both Girma and Wadata have implemented provider behavior change initiatives focused on community health workers. See **Appendix A** for further details on the organizational structure and included SBC activities.

Breakthrough RESEARCH conducted an evaluation of the RISE II initiative by examining the cost and impact of SBC activities on priority health behaviors and outcomes in Niger. The original cost-effectiveness study design planned to pair the total SBC expenditures for RISE II with the total health impact estimated at the final Breakthrough RESEARCH survey. However, since the final survey data were not available in the needed time frame to conduct this analysis, this report reviews the cost-effectiveness at midline and will examine hypothetical scenarios of cost-effectiveness through 2025 when RISE II concludes. **Table 1** details the analysis time frame.

Breakthrough ACTION began planning their SBC activities in late 2019 and RFSA SBC activities were delayed and then incrementally started in mid-2020 but limited due to the COVID-19 pandemic and its restrictions on social contacts. Breakthrough RESEARCH's baseline survey was conducted in April and May 2021 and the midline survey was conducted in April and May 2022. Data from the final Breakthrough RESEARCH survey was not available until early March 2023 and is thus not included in this report. An initial cost report analyzed the SBC program expenditures from project initiation in late 2018 to September 2021 (Avenir Health 2022). This report combines the expenditures from the initial report with subsequent expenditures from October 2021 through April 2022 to match the timeframe of the total costs with the impact data collected at midline. Using these inputs, the primary research question addressed in this analysis is what is the cost-effectiveness of RISE II at midline? While it is interesting to explore this question, a one-year change for an SBC initiative is unlikely to yield cost-effective results because more time is typically needed to generate impact on health outcomes. As such, a secondary research question is what increase in health outcomes is necessary to yield cost-effective results by the end of programming activities?

TABLE 1 TIME FRAME FOR RISE II PROGRAMMING AND BREAKTHROUGH RESEARCH'S EVALUATION

TIME FRAME (QUARTER)	RISE II DESIGN PHASE	RISE II SBC DESIGN PHASE	RISE II INTEGRATED SBC ACTIVITIES	BREAKTHROUGH RESEARCH EVALUATION
April – June 2019				
July – September 2019				
October – December 2019				
January – March 2020				
April – June 2020				
July – September 2020			*	
October – December 2020				
January – March 2021				*Baseline*
April – June 2021				
July – September 2021				
October – December 2021				
January – March 2022				
April – June 2022				*Midline*
July – September 2022				
October – December 2022				
January – March 2023				*Final*
April – June 2023				
July – September 2023				
October – December 2023				
January – March 2024				
April – June 2024				
July – September 2024				
October – December 2024				
January – March 2025				
April – June 2025				*RISE II project endline*

*SBC interventions began rolling out gradually during this time period.

METHODS

To evaluate the cost-effectiveness of RISE II SBC interventions, it is necessary to calculate the **incremental cost-effectiveness ratio**, or ICER. An ICER examines the total costs associated with SBC interventions divided by the total impact, following three main steps: 1) estimate the impact of SBC interventions on priority health outcomes, 2) estimate the SBC-related costs, and 3) calculate the ICER.

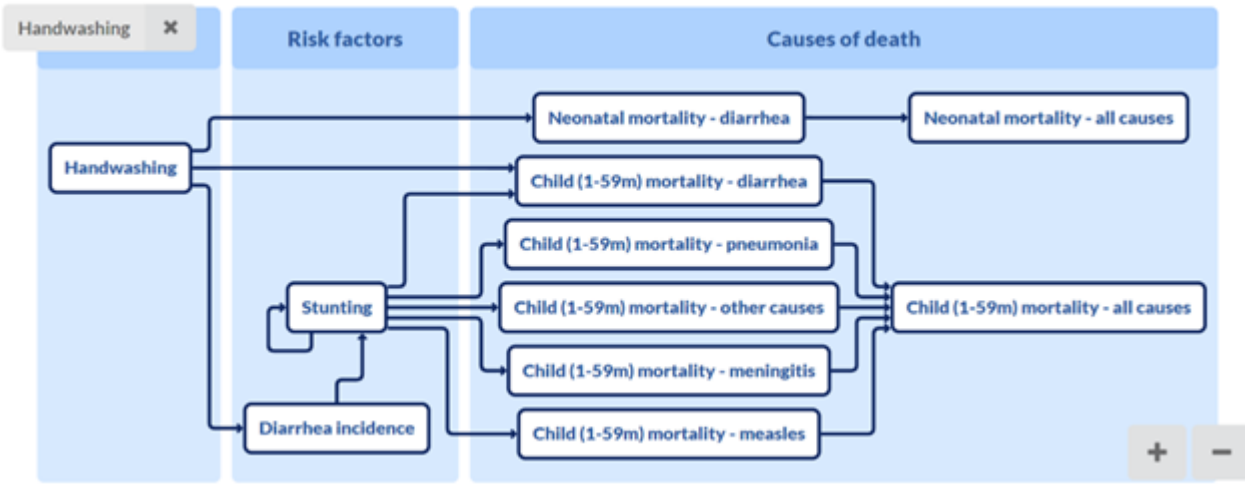
Estimate impact

The foundation for the impact analysis is the Breakthrough RESEARCH RISE II evaluation study, which is a repeated cross-sectional study designed to assess the impact of RISE II SBC programming. The baseline, midline, and final surveys target married/in union women of reproductive age (15–49 years) and assess the ideational factors and behavioral outcomes associated with priority health areas. The baseline study conducted in April 2021 surveyed 1,354 married/in union women of reproductive age (MWRA) between 15 and 49 years in the RISE II programming intervention areas and another 1,355 were interviewed in control areas in the region (i.e., not where RISE II is operating (Dougherty et al. 2022)). At midline, 1,342 were interviewed in the intervention and 1,384 were interviewed in the control areas (forthcoming).

While the RISE II initiative is multisectoral and has more components than just SBC, including agricultural and microfinancing, the health outcomes assessed in this analysis are related to health services utilization and are expected to be largely linked to the SBC programming in RISE II that is focused on addressing barriers to health care-seeking. Because the SBC interventions cross multiple health areas, a common impact measure is needed. As such, a linear deterministic causal model called the **Lives Saved Tool (LiST)** was used to examine how changes in population coverage of specific interventions translate into the number of lives saved over a specified time period. LiST was initially developed in 2003 to estimate the impact of clinical, hospital, and community-based interventions on mortality for children under five years and later expanded to include maternal impacts (Walker et al. 2013). As an example, **Figure 1** shows an example of pathways that map how improvements in handwashing influences risk factors and causes of death in LiST.

Table 2 details five health behavioral outcomes addressed by RISE II SBC programming that are included in LiST and the corresponding baseline and midline values for the intervention and control areas, as well as the percentage point changes from baseline to midline. Some indicators dropped, potentially due to health service and disruptions from COVID-19. Three indicators showed statistically significant changes from baseline to midline at $p<0.05$. In the intervention area, the use of at least four antenatal care (ANC) visits dropped by 9.9 percentage

FIGURE 1 LIST PATHWAYS FOR HANDWASHING INFLUENCING NEONATAL AND CHILD MORTALITY



Source: www.listvisualizer.org

TABLE 2 HEALTH BEHAVIORAL OUTCOMES IN RISE II INTERVENTION AND CONTROL AREAS FROM BASELINE (2021) TO MIDLINE (2022)

	INTERVENTION			CONTROL		
HEALTH OUTCOMES	BASELINE 2021	MIDLINE 2022	% PT CHANGE	BASELINE 2021	MIDLINE 2022	% PT CHANGE
Modern contraceptive prevalence (mCPR) among all women	25.3	24.9	-0.4	21.0	19.5	-1.5
% women who report at least 1 ANC visit during their pregnancy	89.3	89.4	0.1	87.0	82.9	-4.1*
% women who report at least 4 ANC visit during their pregnancy	56.7	46.8	-9.9***	50.4	35.8	-14.6***
% children born in a health facility	55.9	58.1	2.2	56.1	57.2	1.1
% of households living with a handwashing facility on the premises that has soap and water available	15.7	9.9	-5.8**	10.6	9.2	-1.4

*Statistically significant change at p<0.05, **p<0.01, ***p<0.001

points but dropped even more in control areas (14.6 percentage points). The control area also saw a statistically significant drop in women having one ANC visit during their pregnancy (4.1 percentage points). The percent of households living with a handwashing facility on the premises that has soap and water available dropped 5.8 percentage points in intervention areas compared to a 1.4 percentage point drop in control areas.

While improving breastfeeding outcomes was another key behavior addressed by the RISE II initiative, it should be noted that they are not captured in Table 2 due to an inaccurately deployed skip pattern in the baseline survey that resulted in missing information of the age for children needed for these indicators.[a]

The values shown in Table 2 were used to generate a series of LiST scenarios that can be used to examine the number of lives saved that can be attributed to the RISE II initiative. To begin, default national-level population data from Niger were adjusted to reflect the RISE II initiative reach based on project documentation. Next, the following LiST files were created:

1. An *intervention baseline* file that uses the baseline intervention survey values for each of the above behavioral health outcomes in years 2021 and 2022.
2. A *control baseline* file that uses the baseline control survey values for each of the outcomes in 2021 and 2022.
3. An *intervention scaled* file that uses the baseline survey values for the intervention areas in 2021 and the midline values for 2022.
4. A *control scaled* file that uses the baseline survey values for the control areas 2021 and the midline values for 2022.

The number of lives saved were then calculated based on modeled deaths averted at midline. To calculate maternal lives saved, the number of deaths from the scaled-up file capturing changes over time in the intervention areas is subtracted from the baseline file for the same area (Equation 1). The same calculation is made for the control areas (Equation 2).

Equation 1: Maternal deaths averted at midline based on intervention results (2022)

$$\text{Lives saved} = \text{BASELINE/INTERVENTION (Maternal deaths)} - \text{SCALED/INTERVENTION (Maternal deaths)}$$

Equation 2: Maternal deaths averted at midline based on control results (2022)

$$\text{Lives saved} = \text{BASELINE/CONTROL (Maternal deaths)} - \text{SCALED/CONTROL (Maternal deaths)}$$

Due to underlying population dynamics, the best approach for calculating the number of lives saved based on changes in the behavioral health outcomes differs

[a]Due to COVID-19, the Washington, DC-based study team was unable to travel and participate with the Niger-based team in the training and study tool piloting. As a result, it was more challenging to provide close oversight and ensure that the paper-based study tool was accurately deployed on the mobile application. The skip pattern was corrected in the midline survey and a comparison of midline and the final survey will be available in the final evaluation manuscript.

for mothers and children. For children, the number of lives saved were estimated for each intervention in the scaled-up file in the LiST results. Then, to estimate the number of lives saved at midline attributable to RISE II, the number of lives saved in the files using the control values were subtracted from the lives saved using the intervention values (Equation 3).

Equation 3: Estimated lives saved due to RISE II initiative at midline (2022)

$$\text{Lives saved} = \text{INTERVENTION (Maternal lives + Child lives)} - \text{CONTROL (Maternal lives + Child lives)}$$

The number of lives saved generated from this equation was translated into disability-adjusted life years (DALYs) averted using data obtained from the **GBD Results Tool** for Niger. Total "DALYs averted" are comprised of the years of life lost to death (YLL) and the years of life lived with disability (YLD). For each relevant cause of death, the total deaths and total DALYs were obtained for Niger to calculate the number of DALYs per death, which were then applied to the lives saved attributable to the RISE II initiative. For example, an increase in the proportion of facility-based births results in saving newborn lives and there are approximately 90 DALYs averted associated with saving a newborn life due to interventions reducing childbirth complications. Following standard practices for cost-effectiveness evaluation, future DALYs averted were discounted at 3% (IDSI 2022).

Acknowledging that substantial behavior changes are unlikely to occur in the year between baseline and midline survey due to the SBC activities, two further sets of hypothetical scenarios were examined. First, a **25% improvement** scenario explored what the impact would be if the outcomes in the intervention group increased by 25% by 2025 compared to a control group where the outcomes remained constant at their 2022 levels through 2025. Second, a **25% + breastfeeding** scenario examined the same hypothetical 25% increase between 2022 and 2025 for the intervention area and also included hypothetical increases of 25% by 2025 in breastfeeding outcomes, which were not adequately measured in the Breakthrough RESEARCH surveys, although SBC interventions were provided in these areas. Baseline breastfeeding health outcomes were obtained from a 2021 population-based survey, relying on the average percentages for Maradi and Zinder (INS 2022). **Table 3** details the values included in the scenarios, where the values incrementally increase to a 25% increase by 2025 in the intervention scenario, and the 2022 values from the midline survey remain constant through 2025 in the control scenarios.

Similar to the midline impact calculation, the number of lives saved for the two hypothetical scenarios were captured by subtracting the lives saved from the control scenarios from the lives saved in the intervention scenarios (Equation 4).

TABLE 3 HEALTH OUTCOMES VALUES USED IN THE TWO HYPOTHETICAL IMPACT SCENARIOS

OUTCOMES	2021	2022	2023*	2024*	2025*
25% hypothetical scenario					
mCPR	25.3	24.9	27.0	29.1	31.1
ANC 1	89.3	89.4	91.3	93.1	95.0**
ANC 4	56.7	46.8	50.7	54.6	58.5
Facility-based birth	55.9	58.1	62.9	67.8	72.6
Handwashing	15.7	9.9	10.7	11.6	12.4
25% (above) + breastfeeding (below) scenario-only					
Early initiation breastfeeding***	68.0	72.3	76.5	80.8	85.0
Exclusive breastfeeding (1 month)***	23.8	25.3	26.8	28.3	29.8
Exclusive breastfeeding (under 6 months)***	14.0	14.9	15.8	16.6	17.5
Any breastfeeding (6–12 months)***	97.0	97.3	97.5	97.8	98.0
Any breastfeeding (13–24 months)***	76.0	80.8	85.5	90.3	95.0*

*Hypothetical values; **Max value capped at 95%; ***Baseline values from INS 2022 study for Maradi and Zinder.

Equation 4: Estimating potential lives saved at endline due to RISE II initiative using hypothetical scenarios

$$\text{Lives saved endline (2022–2025)} = \text{INTERVENTION (Maternal lives + Child lives)} - \text{CONTROL (Maternal lives + Child lives)}$$

Estimate costs

The costing component of this analysis follows Breakthrough RESEARCH's **Guidelines for Costing of Social and Behavior Change Health Interventions**, which include 17 principles of design, data collection, analysis, and presentation for SBC costing studies (Rosen, Plosky and Bollinger 2019). SBC expenditures were collected in two phases. The first phase collected SBC expenditures from the project initiation in 2018 through September 2021 and were summarized in Breakthrough RESEARCH's initial cost report, which explored the allocation of expenditures in different categories (e.g., personnel, travel, indirect) (Avenir Health 2022). The second phase captured SBC expenditures from October 2021 through September 2022. Data requests for the second tranche of SBC expenditures began in October 2022, with follow up conducted through January 2023. For CCP, transaction data were made available, while total expenditures were submitted by the other partners where transaction data were not available.[b]

When aggregating expenditures across time periods, the total expenditures were adjusted to 2022 United States dollars (USD) using the **United States gross domestic product (GDP) deflator**. The CCP transaction data detailed SBC expenditures by date. We used the proportion of the annual expenditures spent each month by CCP to estimate the monthly RFSA expenditures by applying that proportion to the annual reported expenditures for each RFSA. Since implementation of SBC activities began gradually in mid-2020, the prior start-up costs in 2019 and the first half of 2020 were amortized over the life of the RISE II project, where the RFSAs plan to continue the SBC activities to 2025. Total expenditures were calculated at midline (April 2022) and the SBC expenditures per person in the intervention areas were also calculated using the intervention area population estimate of 548,474, based on provided census data.

[b]Transaction data detail specific expenditures, such as office utilities, and the associated date, amount, and other details.

To calculate SBC expenditures beyond midline, to be used in the hypothetical 25% and 25%+breastfeeding scenarios that extend out to 2025, the monthly average spend from January 2021 to September 2022 was used to project expenditures going forward through June 2025 at a constant rate. Expenditures for 2023 through 2025 were discounted at 3%, following standard practice for cost-effectiveness evaluations (IDSI 2022).

In addition to SBC expenditures, there are service delivery costs associated with changes in the behavioral health outcomes. For example, increases in mCPR will result in additional commodity costs. LiST contains a costing module that estimates the total intervention costs associated with health behavior outcomes modeled in the application using default values (Bollinger et al. 2017). The total intervention costs were estimated for each scenario and the additional service delivery costs associated with changes in health outcomes were added to SBC expenditures for a more complete assessment of the associated costs related to RISE II.

Calculate cost-effectiveness

Once the impacts and costs were obtained, the ICER was calculated. For the RISE II study, the total costs (SBC expenditures and additional service delivery costs) are divided by the DALYs averted attributed to the SBC program to estimate the cost per DALY averted (Equation 5).

Equation 5: Cost per DALY averted

$$\text{Incremental cost-effectiveness ratio (ICER)} = \frac{\text{SBC expenditures + additional service delivery costs}}{\text{Intervention DALYs averted – Control DALYs averted}}$$

This ICER was then compared to Niger's GDP per capita to assess cost-effectiveness. According to World Health Organization's guidelines, health interventions with a cost per DALY averted that are less than one times the GDP per capita are considered "highly cost-effective" and those between one and three times the GDP per capita are "cost-effective" (WHO 2001). For Niger, the most recent estimate for GDP per capita is $590.60 in 2021 (World Bank 2021). To ensure comparability with the costs, the GDP per capita was adjusted to 2022 United States dollar (USD) using the US GDP deflator, resulting in a value of $631.93. As such, the cost per DALY averted needs to be below $632 for the SBC investments to be considered "highly cost-effective" and below $1,896 to be "cost-effective."

RESULTS

Impact

The number of lives saved generated by the scenarios measuring impact at midline are shown in **Table 4**, where negative numbers represent lives lost due to a lower percentage of the population exhibiting the health behavior from 2021 and 2022. For example, the slight decrease in the mCPR between 2021 and 2022 resulted in one life lost in the intervention scenario and three lives lost in the control scenario. Overall, however, there is a net total of 2 additional lives saved when the value from the control area scenario is subtracted from the value from the intervention area scenario (e.g., -1 life saved in intervention minus -3 lives saved in control = 2 net lives saved in intervention area). Compared to the control, a year of life is lost in the intervention area due to the reduction in handwashing with soap. The other health interventions all show lives saved as estimated by LiST due to the increase in facility-assisted births and include clean birth environment, immediate drying and additional stimulation, thermal protection, clean cord care, and neonatal resuscitation. In sum, there were a total of four additional lives saved in the intervention areas, yielding 122 net DALYs averted.[c]

Far more DALYs averted are generated in the two hypothetical scenarios that extend to 2025, as shown in **Figure 1**. The first scenario, where RISE II is assumed to result in a 25% improvement in the existing health outcomes by 2025, yields a total of 4,835 DALYs averted. The majority of DALYs averted are related to childbirth and due to improvements in facility-based birth and maternal lives saved due to contraception. The second scenario, which adds improvements in the breastfeeding outcomes not captured in the midline scenario or first hypothetical scenario, increases the total DALYs averted to 12,131 DALYs averted, a gain of approximately 7,300 DALYs.

FIGURE 1 DALYS AVERTED FOR MIDLINE AND HYPOTHETICAL SCENARIOS TO 2025

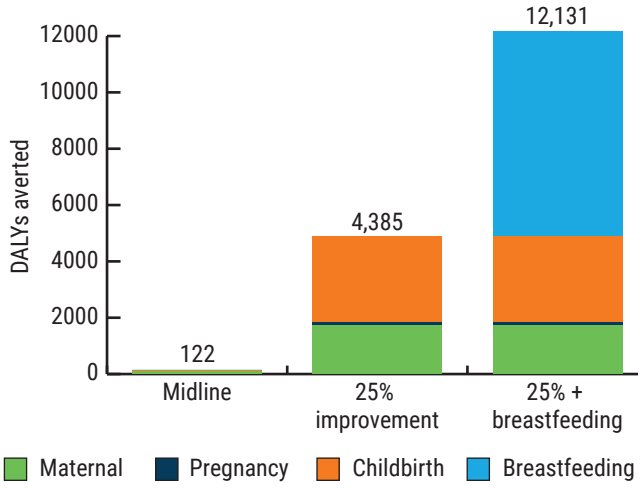


TABLE 4 LIVES SAVED AND DALYS AVERTED AT MIDLINE (2022)

	INTERVENTION	CONTROL	ADDITIONAL LIVES SAVED (INTERVENTION - CONTROL)	DALYS AVERTED
Maternal				
Contraception	-1	-3	2	59
Child				
Clean birth environment	1	0	1	32
Immediate drying and additional stimulation	1	0	1	32
Thermal protection	1	1	0	0
Clean cord care	1	1	0	0
Neonatal resuscitation	1	0	1	32
Hand washing with soap	-1	0	-1	-32
TOTAL	**3**	**-1**	**4**	**122**

[c]When restricting the changes in LiST to outcomes with statistically significant changes, the intervention resulted in zero lives saved.

Cost

The total SBC expenditures from project initiation through the midline survey in April 2022, with design costs appropriately amortized, amount to $5.7 million (2022 USD). This translates to $10.46 per person reached in the RISE II intervention areas. There were uncertainties around the estimated SBC budgets for 2023 through 2025 for some partners. As such, for our projections to 2025, we estimated future SBC expenditures on the current level of spending to align with the assumptions regarding the impact projections. Based on this assumption, the total SBC expenditures increase to $19.9 million (2022 USD).

Table 5 details the SBC expenditures, additional service delivery costs, and resulting total costs for each of the three scenarios. Note that the additional service delivery costs between the intervention and control scenarios at midline are minimal at approximately $5,000, which is less than 0.1% of the total costs. For the two hypothetical scenarios, the additional service delivery costs increase to over $127,000 but are still less than 1% of the total costs. Note that no additional service delivery costs are expected for the addition of breastfeeding and complementary feeding since these interventions are not typically associated with additional service delivery costs. See **Appendix B** for more details on the SBC expenditures.

Cost-effectiveness

TABLE 5 SBC EXPENDITURES AND ADDITIONAL SERVICE DELIVERY COSTS, BY SCENARIO

SCENARIO	SBC EXPENDITURES $	ADDITIONAL SERVICE DELIVERY COSTS $	TOTAL COSTS $
Midline	5,735,490	5,019	5,740,509
25% improvement	19,747,881	127,404	19,875,285
25% + breastfeeding	19,747,881	127,404	19,875,285

Combining the impact and cost estimates results in a "cost per DALY averted" calculated for each of the three scenarios: midline, 25% improvement, and 25% improvement + breastfeeding (see **Table 6**). The midline ICER is $47,005[d] per DALY averted, which is far above Niger's threshold for cost-effectiveness at $1,896. When considering the hypothetical scenario that increases the health outcome impact by 25% in the year 2025, the ICER improves substantially to $4,111 per DALY averted, but this would still be considered not cost-effective. However, when the potential breastfeeding feeding outcomes that could not be captured at midline are included, with the additional DALYs averted now included, the ICER becomes $1,638, which is below the threshold for cost-effectiveness and thus investments in SBC under this scenario would be considered cost-effective.

TABLE 6 COST-EFFECTIVENESS RESULTS COMPARED TO GDP PER CAPITA THRESHOLDS*

SCENARIO	ICER: COST PER DALY AVERTED	COST-EFFECTIVENESS DETERMINATION
Midline	$47,005	Not cost-effective
25% improvement	$4,111	Not cost-effective
25% + breastfeeding	$1,638	Cost-effective

*An ICER below $1,896 is cost-effective and below $632 is highly cost-effective, based on the GDP per capita in Niger

[d] When restricting impact to outcomes with statistically significant changes, there are no additional lives saved and thus no DALYs averted. As such the cost per DALY averted cannot be calculated.

DISCUSSION

Key findings

This study is one of the first to examine the cost-effectiveness of integrated SBC programming. We present three key findings that shed light on whether SBC interventions are or could be cost-effective in Niger. First, **the ICER using the results from the midline scenario of $47,005 per DALY averted is not cost-effective**, and in fact is much higher than the cost-effective threshold of $1,896. Originally, the cost-effectiveness analysis was intended to be based on the final survey at the conclusion of Breakthrough RESEARCH's activities; however, the midline survey was used due to time constraints. The disappointing ICER is not surprising given the time span between the baseline and midline, which is insufficient to feasibly observe changes to many of the health outcome indicators that would be influenced by SBC programming. For example, for a measurable increase in antenatal care seeking to be observed, women would need to be exposed to the SBC content, be or become pregnant, and newly attend antenatal care to see an increase in this outcome variable. As such, the number of women who could potentially change their behaviors in a one-year time frame is limited. Furthermore, RFSA programming related to COVID-19 likely influenced some of the measured outcomes from baseline to midline. Note the percentage of households living with a handwashing facility dropped from 15.7% in 2021 to 9.9% in 2022. This drop is perhaps due to an artificially high level of handwashing in the early stage of the pandemic, between the onset of the pandemic in 2020 to 2021, and then later waned in 2022. This metric dropped also in the control area, although to a lesser extent. For these reasons, looking forward to future studies, one recommendation is that researchers use project midline to explore other relevant costing questions at project midline, such as the primary cost drivers of the interventions or calculating unit costs, but not focus on midline cost-effectiveness.

A second major finding from this analysis is that **cost-effectiveness of the RISE II SBC program is achievable if substantial positive changes in health outcomes occur by project endline**. The 25% + breastfeeding scenario is below the cost-effective threshold for Niger. While a 25% increase in outcomes due to SBC interventions is substantial, it is not beyond the bounds of what has been seen in the literature (Saggurti et al. 2018, Fidele et al. 2012). It may be more challenging to reach these levels of increases in some health behaviors than others. For example, a 25% increase in mCPR would be a very substantial gain, as opposed to breastfeeding indicators, which have shown stronger relationships with SBC interventions (Rosen et al. 2019, Avenir Health 2023). A similar survey of the outcomes at endline in 2025 would reveal whether this level of change occurred for the key outcomes in this analysis. Note that when a 20% increase was used across all outcomes, the results were no longer cost-effective.

The third key finding is the **importance of capturing all relevant outcomes in an impact measure for cost-effectiveness analysis**. In this projection, the inclusion of the breastfeeding outcomes is critical for achieving the cost-effectiveness threshold (without it, a 25% increase in all other outcomes results in SBC investments that would not be considered cost-effective at project endline). For RISE II, the breastfeeding improvements are unknown at present due to complications in the data collection at baseline due to COVID-19, although SBC messaging on breastfeeding did occur. However, prior research has shown that investments in SBC interventions encouraging breastfeeding can be highly cost-effective (Avenir Health 2023). For integrated SBC overall, missing the inclusion of a priority health behavior from the impact denominator is problematic for the analysis because it underestimates important health gains. After the baseline survey was conducted, the RISE II initiative also included SBC malaria interventions as well, which have also been found to be highly cost-effective (Avenir Health 2021) and would have likely favorably influenced the results but without baseline data these could not be captured in this analysis. A bigger challenge emerges for multisectoral programs like RISE II, where work in other sectors and outcomes, such as improving agricultural yields and reducing early marriage have known economic benefits, but these benefits do not map to health outcomes like those modeled here (UNFPA 2022). Future studies on the cost-effectiveness of integrated SBC in health should take care in assessing what outcomes can be mapped to a common denominator and ensuring those data are adequately captured. For integrated SBC projects that cross different sectors, other approaches such as a benefit cost-ratio analysis, will likely yield more complete and thus more favorable results, but they are also more difficult to conduct.

Limitations

As with all modeling studies, the analysis relies on various data inputs and assumptions. The expenditure analysis made several assumptions in allocating above-site expenditures and distributing costs over the project time period. On the impact side, as noted in the methods section, most of the percentage changes seen between baseline and midline outcomes were not statistically significant, likely due to the short timeframe between the two surveys. Some of the changes seen between these two time periods were also potentially influenced by other extenuating circumstances, such as changes in governmental policies and environmental conditions, although these occurred in both the intervention and control areas. Additionally, this analysis assumes that the changes in the health indicators are due to SBC programming and not the other RISE II activities, such as direct food aid and agricultural support.

Conclusions

While a one-year time frame is premature for yielding useful cost-effectiveness results, the hypothetical scenarios included in this analysis indicate that if substantial gains are made in key health outcomes, cost-effectiveness could be achieved by project end, although these scenarios are, of course, speculative. Looking forward, more research is needed to examine the cost-effectiveness of integrated SBC and further exploration on what types of integrated programming are most cost-effective.

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APPENDIX A
ORGANIZATIONAL CHART AND SBC ACTIVITIES

FIGURE A1 PARTNERS FOR RISE II IN NIGER

TABLE A1 PLANNED SBC ACTIVITIES BY RFSA

SBC INTERVENTION	GIRMA CATHOLIC RELIEF SERVICES	HAMZARI CARE	WADATA SAVE THE CHILDREN
Mass media	Radio	Radio	Radio
SMS	SMS messaging around nutrition/health		
IPC	Several group IPC interventions focused on grandmothers, mothers, youth, and household visits	Household visits on child wellness, peer educator groups, group IPC for pregnant women, mothers, and husbands	Several group IPC interventions focused on youth, mothers, and husbands
Community awareness raising	Video viewings and other community events	Awareness raising talks, cultural troops, cooking demonstrations, video screenings	Messaging through religious leader sermons
Community engagement	Engagement with traditional chiefs and religious leaders, and community dialogues	Community stakeholder engagement	Peer-led community forums, engagement with community influencers
Provider behavior change	Work with community health workers		Enhance trust and communication with community health workers
Other SBC activities	Several activities related to literacy, agriculture, financial literacy, sanitation, leadership and governance, and emergency planning	Several activities related to agriculture, gender	Several activities related to food security, agriculture, economic development, emergency planning and community infrastructure that have implications for health

APPENDIX B
ADDITIONAL SBC EXPENDITURE DETAILS

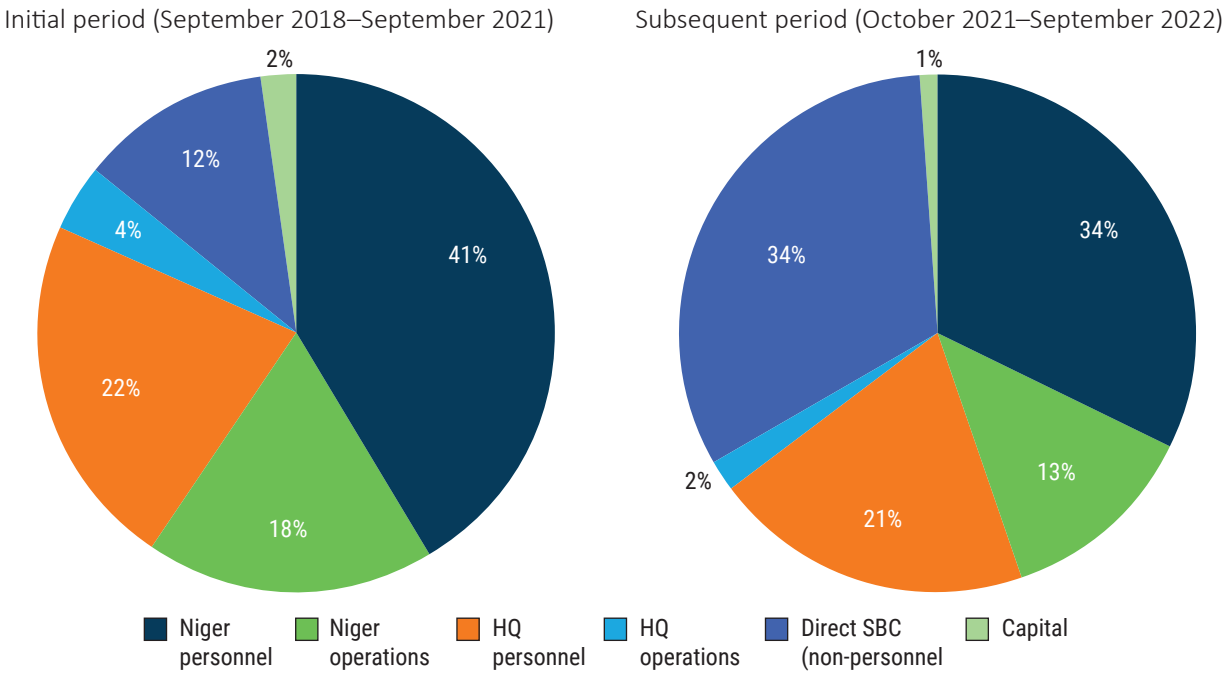
The total SBC expenditures examined for the analysis included actual SBC expenditure data from the program inception—starting in September 2018 through September 2022. For the cost-effectiveness analysis, the expenditures were adjusted to amortize the start-up design costs over the life of the project (to 2025) and were adjusted to 2022 USD to match the impact analyses. Additionally, the midline costing scenario included expenditures and service delivery costs up to May 2021, while the hypothetical projected scenarios were estimated to 2025 based on average monthly expenditures.

Returning to the actual SBC expenditures (not amortized or adjusted for inflation), the total SBC expenditures were estimated at $7.2 million for the initial data collection period of September 2018–September 2021 and an additional $3.8 million for the subsequent data collection period of October 2021–September 2022, for a total of $11.1 million from project initiation through September 2022.

Figure B1 below shows the changing composition of expenditures between the initial and subsequent data collection period. In both time periods, the majority of the expenditures were allocated to personnel, totaling 63% in the initial period and 55% in the subsequent period. This allocation is consistent with many of the planned SBC activities, such as community SBC engagement, which is highly personnel intensive.

One key shift between the two data collection periods is a change in the proportion of expenditures focused on direct non-personnel SBC expenditures, such as media costs and information, education, and communication materials, which increased from 12% during the initial period to 34% in the subsequent period. This shift reflects the move to full implementation of activities in the subsequent phase. Capital and headquarter operation expenditures remained low during both time periods. Future costing efforts at project endline in 2025 may reveal additional shifts in expenditure allocation that are informative for future budgeting and planning purposes.

FIGURE B1 ALLOCATION OF RISE II SBC EXPENDITURES



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