

Implementation of a Rooftop Farm Integrated With a Teaching Kitchen and Preventive Food Pantry in a Hospital Setting

Safety-net hospitals serving populations with disproportionately high levels of poverty, food insecurity, and chronic disease can utilize innovative strategies to improve the health and environment of their communities. Boston Medical Center in Boston, Massachusetts, constructed an on-site rooftop farm to provide fresh produce for the hospital's preventive food pantry, teaching kitchen, cafeterias, and inpatient meal services. This novel model can be replicated by other organizations aiming to alleviate food insecurity, encourage healthy eating, and promote environmental sustainability. (*Am J Public Health*. 2019;109:1119–1121. doi:10.2105/AJPH.2019.305116)

Aviva A. Musicus, BA, Kelsey A. Vercammen, MSc, Aarohee P. Fulay, MPH, Alyssa J. Moran, ScD, RD, Tracey Burg, RD, LDN, Lindsay Allen, BA, David Maffeo, BBA, Andi Berger, MA, and Eric B. Rimm, ScD

Safety-net hospitals serving populations with disproportionately high levels of poverty, food insecurity, and chronic disease can utilize innovative strategies to improve the health and environment of their communities.

INTERVENTION

We describe the implementation of the Boston Medical Center (BMC) rooftop farm. The farm's goal is to distribute high-quality produce to BMC patients and their families, employees, and visitors through the hospital's preventive food pantry, teaching kitchen, cafeterias, and inpatient meal services.

PLACE AND TIME

The 2658-square-foot rooftop farm is located in the South End neighborhood of Boston, Massachusetts, and has been operational since April 2017 (Figure 1).

PERSON

BMC is the largest safety-net hospital in New England, and 16% of its patients are food-insecure (David Maffeo, written communication, March 13, 2019). The farm contributes

food to the hospital's cafeterias (serving patients, employees, and visitors 1800 meals daily), inpatient meal services (567 beds, 1200 meals daily), teaching kitchen (1800 patients and staff attending 280 free classes annually), and preventive food pantry (reaching 83 288 food-insecure patients and household members annually with 120 new prescriptions monthly).

PURPOSE

Motivation for building the farm varied across stakeholder roles and included (1) providing high-quality produce to patients to alleviate food insecurity; (2) supporting the hospital's commitment to environmental sustainability; (3) benefiting employees, patients, and the community through social engagement, education, and enhanced well-being; and (4) promoting the hospital's image and attracting donors.

IMPLEMENTATION

The rooftop farm was conceptualized by two senior managers at BMC. After acquiring funding for installation and roof modifications (~ \$300 000, obtained primarily through a large annual fundraising event), the farm was built in collaboration with outside consultants, Recover Green Roofs and Higher Ground Farm, during the course of 5 months. The BMC farm now consists of 2243 milk crate planters growing more than 25 crop varieties and two beehives housing more than 100 000 bees. The farm operates April through November and is maintained by a full-time farmer, part-time assistant, and hospital employee volunteers. The farm exclusively uses organic seeds and farming practices, but is not US Department of Agriculture-certified organic. To ensure food safety, harvested vegetables are washed two or three times and transported in sanitized food-grade bins, and soil and water quality are regularly tested.

ABOUT THE AUTHORS

Aviva A. Musicus, Aarohee P. Fulay, and Eric B. Rimm are with the Department of Nutrition, Harvard T. H. Chan School of Public Health, Boston, MA. E. B. Rimm and Kelsey A. Vercammen are with the Department of Epidemiology, Harvard T. H. Chan School of Public Health. Alyssa J. Moran is with the Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. Tracey Burg, Lindsay Allen, David Maffeo, and Andi Berger are with Boston Medical Center, Boston.

Correspondence should be sent to Aviva A. Musicus, Department of Nutrition, Harvard T. H. Chan School of Public Health, 655 Huntington Ave, Building II, Room 320, Boston, MA 02115 (e-mail: aam231@mail.harvard.edu). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

This article was accepted March 28, 2019.
doi: 10.2105/AJPH.2019.305116



Source. Copyright of Brendan Shea, Recover Green Roofs, LLC. Reproduced with permission of the photographer. Available at: <http://www.recovergreenroofs.com>. Recover Green Roofs designed and installed the rooftop farm.

FIGURE 1—Aerial View of Boston Medical Center's Rooftop Farm

Produce from the BMC farm is distributed through four main outlets: the food pantry, teaching kitchen, hospital cafeterias, and inpatient meals. The BMC food pantry is a service to which primary care providers can refer patients experiencing food insecurity or special nutritional needs. Food pantry prescriptions allow patients to visit the pantry every two weeks to receive three to four days' worth of food for their household. When the farm is in operation, its vegetables supplement the food pantry stock, representing approximately 5% of total food distributed. Within BMC's teaching kitchen, employees, patients, and their families can attend free classes to learn to cook healthy meals with produce from the food pantry and picked directly from the farm. Harvested produce is also incorporated into hospital cafeteria menus and inpatient meals. The farm additionally provides tours, educational events, and a summer culinary camp to members of the South End community.

EVALUATION

To evaluate the farm's output, we collected data on seasonal

production volume, distribution, and cost. To assess implementation, authors trained in qualitative research and unaffiliated with BMC conducted structured interviews with key BMC personnel (e.g., food service staff, facilities managers, volunteers) from September to November 2017 ($n = 18$). Interviewees were identified by senior BMC leadership, and snowball sampling was used to capture other stakeholders identified during interviews, which were recorded and transcribed verbatim. Using iterative thematic analysis in NVivo11 (QSR International, Melbourne, Australia), we assessed interviewee perspectives on (1) why the farm was created, (2) factors conducive to the farm's success, (3) implementation successes and challenges, and (4) how BMC has engaged with its community during this process (see the box on the next page).

Between June and November 2017, the farm produced more than 5200 pounds of produce: 2955 pounds of leafy greens, 81 pounds of herbs, and 2182 pounds of other vegetables. In this first growing season, 3002 pounds of farm vegetables were distributed through the

preventive food pantry, 2208 pounds were distributed to the kitchen for use in cafeteria and inpatient meals, and 8 pounds were directly picked by the teaching kitchen. The overall reduction in spending on food purchased from external vendors from the farm's vegetable production was approximately \$10 000.

Key stakeholder interviews revealed other successes of the farm and its integrated programs. Many interviewees mentioned environmental benefits (e.g., reducing the hospital's carbon footprint), while others believed the farm promoted a positive image for the hospital, which has helped to attract donors. Interviewees also discussed the positive effects on employees, volunteers, and patients (e.g., enhanced well-being attributable to interactions with green space). Others discussed the farm's beneficial promotion of nutrition in the community, including patients' families and summer culinary camp attendees. One interviewee summarized the overall benefit of the farm:

[The farm] hits all areas of our patient care. We're giving the food to the patients in their rooms, we're feeding them in the cafeterias, we're giving it to the community through our food pantry—we feed the whole family when it goes there—and then we're teaching people how to use that food!

Structural factors conducive to the farm's successful implementation included strong leadership, motivated employees, an existing donor pool, and strategic partnerships with consultants. Interviewees felt the farm fit well with the hospital's mission, which includes a dedication to social responsibility and environmental sustainability, and an emphasis on a holistic approach to health.

Finally, BMC's physical environment (a flat roof with access to sunlight) was ideal for a farm.

ADVERSE EFFECTS

The farm's rooftop location on BMC's power plant restricts access to certain people and introduces difficulties in coordinating farm tours and volunteer opportunities. In addition, the farm had a relatively high start-up cost and a compressed five-month timeframe to fundraise and construct to achieve a full growing season.

SUSTAINABILITY

The farm and its coordinated programs have benefited the community in many ways and are expected to continue to do so in future years. Annual operating costs of the farm are approximately \$50 000, which BMC will fund through the food pantry's endowment, donations, and grants. This covers labor (full-time farmer, operational months only: \$32 000; part-time farmer: \$2000); soil inputs (\$6200); beehive labor and maintenance (\$4800); Recover Green Roofs' check-ins, irrigation installation, and winterization (\$2200); and miscellaneous supplies (\$1300). Potential future plans include expanding the farm to cover more of the roof, producing new vegetable varieties, and expanding volunteer opportunities and community outreach. The farm's infrastructure is long-lasting; crate liners will be replaced in five to seven years, and crates will be replaced in 10 to 15 years.

PUBLIC HEALTH SIGNIFICANCE

One in eight Americans experiences food insecurity,¹ which

EMERGENT THEMES FROM KEY INFORMANT INTERVIEWS REGARDING BOSTON MEDICAL CENTER'S ROOFTOP FARM

Why was the farm created?

- To provide high-quality produce to patients to alleviate food insecurity (i.e., increase access to sufficient, safe, and nutritious food)
- To support the hospital's commitment to environmental sustainability and social responsibility
- To benefit employees, patients, and the community through social engagement, education, and enhanced well-being
- To promote the hospital's image and attract donors

What factors were conducive to the farm's success?

- Financial factors, including BMC's existing donor pool
- BMC's dedication to social responsibility, including community and environmental responsibility
- Clear vision, strong leadership, strategic partnerships, and motivated employees
- Existing rooftop in good location

What were successes of farm implementation?

- High-quality vegetables
- Benefits to patients, employees, and the broader hospital community
- Financial benefits, including reduction in spending on food purchased from external vendors and donor attraction
- Improved hospital image

What were challenges of farm implementation?

- Coordination with volunteers and between farm and cafeterias
- Financial difficulties, including relatively high start-up cost and compressed timeframe

How did BMC engage with its external and internal community during this process?

- Internal community (donors, employees, and patients): engagement through teaching kitchen, food pantry, cafeterias, inpatient meals, summer camp, tours, and volunteer opportunities
- External community (South End, media, other hospitals): engagement through tours, conference presentations, press releases, and corporate communications

Note. BMC = Boston Medical Center.

is linked to poor health outcomes and higher health care costs.²⁻⁴ The Affordable Care Act includes several provisions that incentivize investments in social determinants of health, including a community benefit requirement for nonprofit hospitals to retain their tax-exempt status and reforms to medical payment and delivery systems that reimburse based on patient outcomes or total cost of care.^{5,6} Although BMC has not yet evaluated the farm's effects on health or food insecurity, investment in preventive services, such as BMC's farm and associated programs, could reduce long-term health care costs while benefitting patients, employees, and visitors.

BMC has taken a unique, systems-based approach to improving food access and

education in an underserved community. The integration of the hospital's rooftop farm, preventive pantry, cafeterias, and teaching kitchen provides a novel framework that could be replicated by other hospitals nationwide. **AJPH**

CONTRIBUTORS

E. B. Rimm and A. Berger conceptualized the study. A. A. Musicus, A. J. Moran, and A. P. Fulay developed the interview guide and conducted qualitative interviews with participants. A. A. Musicus and K. A. Vercammen developed the codebook. A. A. Musicus analyzed and interpreted the data and drafted the article. A. J. Moran and K. A. Vercammen critically reviewed the data analysis and article. T. Burg, L. Allen, A. Berger, D. Maffeo, A. P. Fulay, and E. B. Rimm provided critical article revisions. All authors approved the final version of the article.

ACKNOWLEDGMENTS

A. A. Musicus is supported by the National Institute of Environmental Health Sciences of the National Institutes of

Health (NIH) under training grant 5T32ES007069-37.

The authors would like to thank Boston Medical Center for their collaborative partnership.

Note. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of NIH.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

The Harvard T. H. Chan School of Public Health institutional review board approved this study.

REFERENCES

- Coleman-Jensen A, Rabbitt MP, Gregory CA, Singh A. Household food security in the United States in 2017. *ERR-256*. Washington, DC: US Department of Agriculture, Economic Research Service; 2018.
- Gundersen C, Ziliak JP. Food insecurity and health outcomes. *Health Aff (Millwood)*. 2015;34(11):1830-1839.

- Berkowitz SA, Basu S, Meigs JB, Seligman HK. Food insecurity and health care expenditures in the United States, 2011-2013. *Health Serv Res*. 2018;53(3):1600-1620.

- Gregory CA, Coleman-Jensen A. Food insecurity, chronic disease, and health among working-age adults. *ERR-235*. Washington, DC: US Department of Agriculture, Economic Research Service; 2017.

- James J. Nonprofit hospitals' community benefit requirements. Under the Affordable Care Act, many nonprofit hospitals must meet new requirements to retain their tax-exempt status. *Health Affairs Health Policy Brief*. Bethesda, MD: Project Hope; 2016.

- Abrams M, Nuzum R, Zezza M, Ryan J, Kiszla J, Guterman S. The Affordable Care Act's payment and delivery system reforms: a progress report at five years. *Issue Brief (Commonw Fund)*. 2015;12:1-16.