By Yasser Bhatti, Andrea Taylor, Matthew Harris, Hester Wadge, Erin Escobar, Matt Prime, Hannah Patel, Alexander W. Carter, Greg Parston, Ara W. Darzi, and Krishna Udayakumar

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Global Lessons In Frugal Innovation To Improve Health Care Delivery In The United States

ABSTRACT In a 2015 global study of low-cost or frugal innovations, we identified five leading innovations that scaled successfully in their original contexts and that may provide insights for scaling such innovations in the United States. We describe common themes among these diverse innovations, critical factors for their translation to the United States to improve the efficiency and quality of health care, and lessons for the implementation and scaling of other innovations. We highlight promising trends in the United States that support adapting these innovations, including growing interest in moving care out of health care facilities and into community and home settings; the growth of alternative payment models and incentives to experiment with new approaches to population health and care delivery; and the increasing use of diverse health professionals, such as community health workers and advanced practice providers. Our findings should inspire policy makers and health care professionals and inform them about the potential for globally sourced frugal innovations to benefit US health care.

Yasser Bhatti is a research fellow in frugal innovation, Institute of Global Health Innovation, Imperial College London, in the United Kingdom.

Andrea Taylor is a program director at Innovations in Healthcare, Duke University, in Durham, North Carolina.

Matthew Harris (m.harris@imperial.ac.uk) is a clinical senior lecturer at the Institute of Global Health Innovation, Imperial College London.

Hester Wadge is contingency planning lead for adult social care, UK Department of Health, in [please provide city name].

Erin Escobar is a program director at Innovations in Healthcare, Duke University.

Matt Prime is a clinical research fellow at the Institute of Global Health Innovation, Imperial College London.

Hannah Patel is insight manager at Q Improvement Lab, Health Foundation, in [please provide city and country name].

Alexander W. Carter is a health economist at the Institute for Global Health Innovation, Imperial College London.

Greg Parston is an executive adviser at the Institute of Global Health Innovation, Imperial College London.

This special issue of *Health Affairs* focuses on lessons from empirical analyses of low-cost health care innovations around the world that offer effective approaches to assessing costs and benefits and promoting cost containment. In reality, the sourcing and adaptation of innovative health care delivery models to new countries and markets is fraught with challenges. *Frugal innovations*, defined by Marco Zeschky and coauthors as "'good-enough,' affordable products that meet the needs of resource-constrained consumers,"[1] can also be defined as "means or ends, to do more with less, for the many."[2,3] We understand them to improve quality at the same cost, offer the same quality at lower cost, or both.

Frugal innovations are often associated with resource-constrained contexts[3,4] and institutionally void or complex settings,[2,3] but there is much potential for them to be adopted in high-income settings. Well-recognized examples include $2,000 heart surgery at Narayana Health, a hospital in India, and $30 cataract surgery at Aravind Eye Hospital, another Indian institution—both successful process models in that country's context. Yet the relevance of frugal models in health care is not limited to low- and middle-income countries.[5] Escalating demand and global resource constraints are also putting pressure on health systems in high-income countries[6] to deliver more for less, and for many.[2,3]

Reverse innovation, a term that some people find paradoxical,[7] occurs when an innovation conceived, developed, or used in a low- or middle-income country is replicated in a high-income country.[8] This type of innovation has attracted substantial and increasing interest among people who want to adapt health care innovations.[9,10] Despite this, the pace of diffusion of frugal innovations into high-income countries lags behind universal need.[11] This is

Ara W. Darzi is executive chair of the World Innovation Summit for Health, Qatar Foundation, and director of the Institute for Global Health Innovation, Imperial College London.

Krishna Udayakumar is director of Innovations in Healthcare, Duke University.

partly because finding relevant innovations globally is challenging, and also because of the general perception that low-income countries might not have any valuable lesson to teach higher-income countries.[11–13]

Many models come from developing countries or unrelated sectors or industries[14] that might not be held to the strict levels of evidence and information expected in health care. The mainstream health sector relies on published accounts of randomized controlled trials as the benchmark for knowledge and evidence. However, in public health and certain developing or low-resource settings, knowledge about innovations most often comes from practice or grey literature, and less often from systematic reviews of the published literature.[15,16] This may be due to the nature of innovations (for example, it can be difficult to publish articles about early-stage innovations, which may lack evidence), the accessibility of the literature (the most interesting innovations may be found in localized literature not readily accessible in high-income settings), or even cognitive perceptions (the literature is not considered to be relevant or rigorous). But at the same time, Henry Chesbrough[17] and other proponents of open innovation[12] argue that external knowledge sources can lead to increased opportunities for inspiration, relevance, and value creation and to reduced costs of research and development. There is a growing momentum to facilitate open innovation, which has led to the development of sourcing models[18] and databases of health care innovations around the world, such as the Center for Health Market Innovations and the World Innovation Summit for Health 2016 Innovation Showcases.

Another factor slowing the pace of adaptation and scaling up of frugal innovations is that diffusion is a notoriously complex process. Some scholars argue that it may take as long as seventeen years for innovations to be implemented at scale, although with recent advances in information exchange this may be a conservative estimate.[19] Research exploring growth into new markets has shown that the characteristics of the innovation are very important to the rate of diffusion. For example, it is important that the innovation can be tested, its benefits can be measured, there is a clear advantage to its use, and it can be adapted to the local context.[20] Equally, it is important to have good leadership, a readiness to change, the resources to do so, and a defined need for the innovation.[20] Despite multiple frameworks for understanding the challenges involved in speeding up the spread of innovation,[21,22] the challenges persist.

Given the challenges of sourcing innovations—particularly frugal ones—the Institute of Global Health Innovation at Imperial College London and Innovations in Healthcare, a nonprofit organization hosted by Duke University, jointly conducted a global scan in 2015 of frugal innovations from low-, middle-, and high-income countries and developed case studies examining five innovations that may be adaptable to the US health landscape. These innovations use diverse approaches, including technologies, service delivery models, and health domains from cardiac care to mental health care. The innovations were selected based on core characteristics of frugality: affordability, adaptability, and accessibility.[2]

This article describes the commonalities and frugal characteristics among the selected innovations and the lessons learned from them, from both an operational and a scaling perspective, and the system enablers in the United States that support adaptation of these models. We identified the five innovations by systematically searching published and grey literature using well-defined criteria such as frugality and reversibility, rather than relying on anecdotal evidence or convenience sampling as other studies have done.[4,23] Furthermore, we studied the five innovations in depth though primary data collection, and we developed detailed case studies that allowed us to derive themes that are likely to be more coherent and comparable than was the case with previous work.

Study Data And Methods

DATA COLLECTION Before commencing the data collection phase, the Institute of Global Health Innovation and Innovations in Healthcare convened in North Carolina in March 2015 to devise our search, identification and evaluation methodology. We used an emergent-search methodology guided by the definitions of *frugality*[2,3,24,25] and *reversibility*[18,26] drawn from the existing literature and previous empirical studies (for details about our methodology, see online Appendix Exhibit A1).[27] We used Everett Rogers's definition of *innovation*—"an idea, practice, or object that is perceived as new by an individual or other unit of adoption"[28]—with particular emphasis on adoption across regions, as the indicator of successful scaling.[29] To identify a wide variety of innovations, we drew on our respective global networks of leaders, innovators, and entrepreneurs in several health systems. We agreed on a consensus approach to ensure that the Institute of Global Health Innovation and Innovations in Healthcare research teams used similar criteria to short-list innovations, so that the outcomes would be amenable to comparative analysis. Selection criteria included the type of innovation;

Growing interest in the United States in moving health care out of facilities may point providers toward global models.

evidence of frugality and reversibility; and potential for sustainability, scale, and relevance to the United States (Appendix Exhibit A1).[27]

In 2015 the Institute of Global Health Innovation research team analyzed nine global innovation databases through secondary research and literature review. The team also conducted an online survey of fifty global leaders drawn from the institute's network to search for any relevant innovations that had not been identified from the databases. From 2,870 available cases, the team analyzed 520 innovations and selected 91 that met all three criteria: affordability, adaptability, and accessibility. Through an assessment of the innovations' reversibility into the United States and the convening of an expert group of US health leaders that considered their relevance, transferability, and adaptability, the list was narrowed down to 30 innovations. The research team developed two-page briefs on each of these innovations that an expert panel of leaders in the health sector familiar with the US health care system used to select 16 innovations, based on their degree of relevance to the US context. Two of these were selected for full case study development by another expert advisory board, convened by the funder and in conversation with the Institute of Global Health Innovation research team.

Since 2011, Innovations in Healthcare has facilitated a global network of promising health care innovations to support their being scaled up and increasing their impact and to improve health care worldwide. With the help of more than two hundred external partners, promising innovations are identified each year and asked to apply. Through a highly competitive and structured process, applicants are vetted and assessed against selection criteria that consider the degree of innovation, how critical the need is that the innovation addresses, the innovation's sustainability, and its readiness to be scaled up. A small percentage of applicants are invited to join the network annually.

For this study, in 2015 the Innovations in Healthcare research team reviewed its network of fifty-five innovators operating in more than forty countries and selected fourteen innovations that had the most potential to be applicable to the US context. The team also developed two-page briefs on these innovations. Through reviewing these briefs and having conversations with members of the team, the advisory board convened by the funder narrowed the list to eight innovations and selected three for full case study development. Combined with the two innovations identified by the Institute of Global Health Innovation, these constituted the five innovations we analyzed.

The two partners shared interview protocols and developed a common template for the case studies. The partners then independently developed their respective case studies, based on site visits to Brazil, the Cayman Islands, India, Kenya, Mexico, and Singapore. At least two researchers went to each site in 2015. The visits lasted four to five days, on average, and included interviews with around ten people from each site to draw holistic and diverse insights from founders, commissioning leaders, operational managers, and clinical providers. Development of the case studies was based on triangulation of several sources of data such as reviews of the primary and secondary data on the innovations and detailed analysis of documents such as financial reports and business cases. Case studies of 3,000 4,000 words were developed in the period July September 2015 for all five innovations.

DATA ANALYSIS Following the development of the detailed case studies, the partners' teams independently drew lessons from their respective case studies. In October 2015 the teams convened in London and collectively conducted an analysis of the five case studies to find common themes across cases. In doing so, they asked: "Why does this work?" (that is, what is its operating model or financial model?), "How did it scale within its original context?" (that is, what aspects of leadership, adaptability, and the core and peripheral attributes of the innovation allowed it to be scaled up?), and "What would be the benefit to the United States of this innovation?" (that is, to which populations and regulatory environments would it be relevant, and what is its potential for cost reduction?). Crosscutting themes and features of the five innovations were identified through discussion of the case-study data among the research team. Finally, the findings were drafted and iterated until both teams reached consensus on key themes and lessons.

LIMITATIONS Our study had some limitations. First, case-study research is subject to the usual

limitations of generalizability, and since interviews with key informants were based on purposive sampling, it is possible that some selection bias was introduced into the findings. Our selection criteria for the interviews and the cases were not based on representativeness.

Second, there are many challenges to identifying innovations for which detailed, robust evidence is available. Often the innovations are still being developed or were developed in countries that have not invested in rigorous evaluation. We addressed these limitations through a process of consensus-building approaches; the triangulation of multiple data sources, including documents, reports, grey literature, published literature, interview data, and observations; analysis through multidisciplinary perspectives; and validation of our findings through discussions with experts.

Study Results

The five case studies were reviewed by both the Innovations in Healthcare and the Institute of Global Health Innovation research teams to identify the particular characteristics of successful innovations and to determine how these have been delivered at scale (Exhibit 1). An examination of the operating and financial models shows that the innovations, although very different from each other, have some common features.

COMMON FEATURES

▶ **CHANGED SETTINGS AND PROVIDERS:** The first common feature we found was that each innovation lowers costs by changing the settings and providers of care. For example, GeriCare@North (in Singapore) brings specialist care into nursing homes through virtual connections with doctors and the training of nurses. In a program that began in India and has been replicated in the Cayman Islands, Narayana Health uses task shifting to ensure that all staff members work at the top of their scope of practice and that surgeons perform only the tasks for which they are uniquely qualified. BasicNeeds, a program in twelve countries in Africa and Asia, moves care from regional hospitals into communities by training local health workers to identify

EXHIBIT 1

Features of five successful frugal innovations

	MedicallHome	Narayana Health	BasicNeeds	Family Health Strategy	GeriCare@North
Country	Mexico	India	Kenya	Brazil	Singapore
Target population	Primary care users	Tertiary care users	Secondary and tertiary mental health care	Primary care (basic health support and advice) users	Specialist geriatrics tertiary care users
Core feature	Care delivery through telemedicine	Care delivery through lean processes	Systems support through community empowerment	Systems support through community health workers	Care delivery through telemedicine
Scale	National; replicated in the Philippines and adapted in the United States	31 hospitals in 19 cities in India, 800 telemedicine centers globally; hospital model replicated in Cayman Islands	12 countries across Africa and Asia; replication being piloted in the United States	National, with over 100 million beneficiaries (approximately 63% of the population)	National, with the number of facilities doubled in 2015
Financial model	Reach subscribers through telecommunications providers	Fee-for-service model, primarily cash payments	Financing varies with location, coordinated with public health structures and reimbursement models	Publicly funded by just over half of the primary care budget	Publicly funded by the Singapore Agency for Integrated Care
Potential for cost reduction	Preventing one ED visit, one annual check-up, and one follow-up with a specialist yields an average savings of $1,500	Provides heart surgery for less than 10% of the average cost in the United States (many of the savings can be replicated in the United States)	Less expensive workers (such as community outreach workers) and family members are used to help manage care; empirical data show decreased hospitalization rates	The annual cost to the Brazilian government is $50 per person; hospitalization rates are reduced through early diagnosis, care, and long-term monitoring	Telegeriatric consultations have a median cost of $53 and yield savings of $9,101 per facility per year, a 43 percent return on investment

SOURCE Authors' analysis. **NOTES** A more detailed description of the five innovations is available in Appendix Exhibit A2 (see Note 27 in text). ED is emergency department.

The predominant fee-for-service US reimbursement model doesn't necessarily align with the implementation of frugal innovations that reduce demand and utilization.

and treat mental health problems, ensuring local access to medications, and building peer-support networks.

▶ **IMPROVE COMMUNICATION:** Second, the innovations improve and facilitate communication between care providers and patients. In the Family Health Strategy (a nationwide program in Brazil), for example, community health workers provide a bridge between households and care providers. The GeriCare@North innovation uses remote nurse-enabled telemedicine channels to increase nursing homes' access to specialized geriatric care. MedicallHome (which began in Mexico and has been replicated in the Philippines and adapted for US use) provides round-the-clock access to doctors without the need for an appointment or transportation.

▶ **BEHAVIOR CHANGE:** Third, the innovations address health-seeking behavior and utilization patterns to reduce the burden on the health system and manage demand for care. Both MedicallHome and the Family Health Strategy provide early support for minor health issues, which ideally reduces the need for more complex future care. BasicNeeds strengthens self-management and peer support for people living with mental illness, which reduces symptoms and the need for hospitalization.

▶ **EFFICIENCY AND PROCESS IMPROVEMENT:** Finally, these care delivery system innovations can drive both increased efficiency and improved care. Overall, the innovations are not just about providing low-cost care for underserved populations. Rather, they drive value by using leaner processes and simpler organizational structures, and by focusing on continuous improvement. They act as an integrating platform for further innovation. These are not stand-alone, single-purpose innovations: They are adaptive and able to expand and be scaled up, in both size and purpose—which magnifies their impact. Thus, initial frugal delivery innovations can be leveraged as platforms for the adoption and diffusion of additional innovations, which might otherwise be difficult to propagate. For example, MedicallHome is a platform through which targeted health advice can be delivered directly to a paying member of the service. As is the case with the US adaptation, ConsejoSano, the platform can also be used as a health system navigation tool for newly insured populations. The GeriCare@North telemedicine initiative is the platform through which the Singaporean Ministry of Health's program for advance care planning is now being delivered and provides opportunities to deploy new point-of-care diagnostic technologies. The front-line community health workers in Brazil's Family Health Strategy already have close ties to every household in their catchment area and can deliver any intervention considered necessary by the government.

LESSONS FOR TRANSLATION We also examined the scaling and adaptation journeys of the five innovations to find commonalities in how they were scaled up in their original contexts. For example, we looked for the core and peripheral attributes of the innovation and the key features of the context it was being adapted to that supported the innovation. Understanding the core elements of these innovations and the critical factors for their success in their original context is essential for effective translation. We were able to identify several important lessons.

▶ **ENSURE EARLY-STAGE SUPPORT:** First, we found that adequate mentoring, networking, and financial support are critical in the early stages. Each of the five innovations that we studied was able to take root and eventually be scaled up in part because of critical connections to mentors, implementation partners, and start-up financing. For example, MedicallHome's early partnership with Cleveland Clinic to design standardized care protocols provided credibility for the innovation. For every new country program, BasicNeeds invests significantly in mentorship and secures several years of funding to get the program started before transitioning it to self-sufficiency. In Brazil, the community health worker role has spread effectively as a result of comprehensive government support and financing, well-defined training and development within primary care teams, and ownership at the regional and municipal levels.

▶ **ENLIST PROVIDERS' PARTICIPATION:** Second, we found that commitment of senior leaders, early buy-in from staff members, and a dedicated change-management process are as

important as the change itself. While thinking outside of the traditional health system can reveal new approaches, change often engenders strong opposition. It is therefore important to demonstrate strong commitment from senior leaders and to involve staff members early in the innovation process. For GeriCare@North, the development of a specific nurse education program under the direction of key staff members from the enrolled facilities has enabled wider acceptance and dissemination. In the Family Health Strategy, municipal adherence to the delivery model is enabled (indeed, mandated) through legislation, federal incentives, and regional monitoring and evaluation. The commitment of Narayana Health's leaders to both the institution's social mission and the relentless pursuit of efficiency are reflected throughout operations at every level.

▶ **ADDRESS USERS' PREFERENCES:** Finally, tailoring new practices to address users' behaviors and preferences is key. MedicallHome uses near-ubiquitous technology (telephones) to help customers avoid long waits for appointments and the time and expense of traveling to a clinic or hospital. BasicNeeds works with existing community organizations and structures, such as farmers' cooperatives and church groups, to reach and provide care for people with mental illness. The Family Health Strategy delivers care to people's doorsteps and allows for the delivery of health promotion activity to be tailored to the needs of each household.

Discussion

LESSONS IN OPERATIONS AND FINANCING Several recent trends in health care practice and financing in the United States point to potential support for the types of structures and outcomes of the frugal innovation models described above. In addition, current uncertainty in the US health policy landscape may provide new possibilities and sharpen appetites to experiment with new models of care.

New incentives are encouraging health systems to test alternative payment models that focus on population health and frugal care delivery approaches. Innovative models such as MedicallHome and Narayana Health could be attractive in this context because, aligned with current accountable care objectives, they would reward providers for having an impact across the population and reducing the total cost of care across the system. Growing interest in the United States in moving health care out of facilities and into community and home settings may also point providers toward global models. To a large extent, market forces drive health care systems in the United States: Care provision is designed from the provider perspective, and the onus is on the patient to access the system. As demand increases and places additional burdens on health systems, building more hospitals and facilities might not be the best use of resources. Rather, redesigning care provision to be more proactive by shifting it out into the community and by shifting responsibility to the community can make care more accessible. Innovations such as MedicallHome, BasicNeeds, the Family Health Strategy, and GeriCare@North are examples of proactive health care innovations that can help systems cope more efficiently with dramatically increasing demand for health care.

Another common thread across the promising frugal innovations is the use of task shifting as a means of increasing workforce capacity to meet population needs. To respond to the rising demand for care, the United States needs to further consider task-shifting innovations such as Narayana Health, the Family Health Strategy, and BasicNeeds, which draw upon volunteers, technicians, or health care professionals trained to deliver a limited array of tasks very well. Complex patients and tasks are referred "up" to more highly trained providers, while specialists' time—an expensive resource—is reserved for those tasks that only a specialist can perform. Task shifting is already happening in the United States, with expanding roles for physician extenders such as nurse practitioners and physician assistants. Although the United States is unlikely to develop a formal national task-shifting policy, care providers should continue to expand the use of new models of health professionals, work with professional societies and state regulators to better define appropriate roles that balance patient safety and task shifting, and promote flexibility in the use of different types of personnel based on available global evidence.

LESSONS IN SUCCESSFUL SCALING Narayana Health's adaptation from its Indian origins in the Cayman Islands was made possible through a joint venture with Ascension Health, a US-based health care organization, which hopes to gain insights from the process that can be applied in its other markets. Although in this instance the joint venture required substantial investment and a long-term strategy, partnerships can provide a low-risk way to test the adaptation of innovations before full adoption. Piloting with a local partner can also enable better tailoring of innovations to specific contexts. For example, the BasicNeeds innovation is being piloted in Detroit, Michigan, with Southwest Solutions, a local implementing partner that has worked in Detroit since 1972. The partner's

experience can inform the adaptation of the innovation from Africa and Asia to an urban US context. Gericare@North and the Family Health Strategy are large-scale programs involving their countries' ministries of health, so their spread to other countries entails certain requirements and opportunities that are not found in proprietary models of care. Engagement with public-sector entities may be required for their adaptation elsewhere—necessarily involving diplomatic channels—which may therefore be more challenging than other types of adaptation involving private-sector partners.

The types of system-level innovations that simultaneously tackle efficiency, provider quality, and cost are complex and require leadership that looks beyond politics, short-term election cycles, and CEO tenures. We found that a potential challenge in the United States is that the predominant fee-for-service reimbursement model doesn't necessarily align with the implementation of frugal innovations that reduce demand and utilization. However, frugal innovations can still be very valuable in such environments when they are deployed to reduce the total costs of care within a current funding stream (for example, hospitalizations for a particular indication).

We recognize that with the increasing use of value-based models of care and reimbursement in the United States, some of the critical enablers to adopting these models of care may be emerging. In our experience, changes of the scale represented by the five models discussed here can be achieved only with leadership that has been sustained over a period of ten to fifteen years. It takes time to fully assess the benefits of innovations, and it takes leaders who not only implement the innovations but also protect them during the testing period, so that their benefits as well as costs will be identified. Innovations must be protected from changing political whims. The Family Health Strategy was able to scale in Brazil because it was rooted in a massive social reform process post-dictatorship in 1988. The country's new constitution and government's acknowledgment of every citizen's right to health care was a fundamental departure from previous policies. Implementing seismic shifts in access to health care requires seismic and long-lasting shifts in political will.

Conclusion

Despite a wide range of approaches, health domains, and geographic regions, the innovations we have highlighted have key commonalities that play a role in their success. These include changing the providers and settings of care to drive efficiencies and improve value across the system, the effective facilitation and improvement of communication and integration of services, and supporting patients to shift to more appropriate health-seeking behavior and changing the way they interact with the system of care. Although the innovations we discussed have demonstrated their potential for impact in their original contexts, there are complex barriers to their adoption in the United States. For adopters of frugal innovations, knowing one's organization and the innovation, developing robust and sustainable change-management systems, and delayering processes (that is, abandoning old practices to make time and space for new ones) to absorb the new innovation are factors critical to its successful implementation. The potential for successful uptake of each of these innovations in the United States is predicated on addressing potential regulatory, scope-of-practice, funding, governance, training, and delivery issues.

We hope that our findings will inspire health care policy makers and professionals and inform their consideration of the potential for frugal innovations to improve US health care. Further work is needed to develop business cases to pilot these innovations in the United States and to assess the viability of those already being piloted. For instance, there is a need for more active facilitation of knowledge sharing, particularly across borders; raising the comfort level of key stakeholders with innovations from outside the country; and developing more qualitative and quantitative evidence to strengthen the evidence base for frugal innovations and their effectiveness. While much work remains, we are confident that continued exploration of frugal innovation and its scaling and adaptation can help achieve greater impact at lower cost for better health in the United States and beyond. ■

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27 To access the Appendix, click on the Details tab of the article online.
28 Rogers EM. Diffusion of innovations. 5th ed. New York (NY): Free Press; 2003. p. 12.
29 Foster C, Heeks R. Conceptualising inclusive innovation: modifying systems of innovation frameworks to understand diffusion of new technology to low-income consumers. Eur J Dev Res. 2013;25(3):333–55.

Queries

1. Wadge bio, please add the city for her new institution where requested.
2. Patel bio, please add the location for her new institution where requested. If "Health Foundation" isn't the full official name, please add the missing information.
3. Paragraph beginning "*Reverse innovation*," sentence beginning "This is partly," at the last stage we said: "AU: Please reword to clarify what "globally" modifies (it's challenging anywhere in the world to find relevant innovations? it's challenging to find innovations that are relevant everywhere in the world?)." You replied: "OK." However, you didn't reword as requested. Please reword now.
4. Paragraph beginning "Since 2011, ," sentence beginning "With the help," if the edited version has distorted the meaning, please provide new language to clarify the point.
5. Paragraph above "Behavior Change," at the last stage we said: "Author: Do you mean "nurse-enabled telemedicine channels in remote locations," or "telemedicine channels with remote nurses"? Please clarify." You responded by requesting a change in a later part of the sentence, which we made in the text. Please now reword to clarify whether you mean "uses nurse-enabled telemedicine channels in remote locations" or you mean "uses telemedicine channels with remote nurses."
6. Acknowledgment, last sentence, the wording we added at your request at the last stage suggests that an innovation can have views—which is confusing. Please reword to clarify whose views you mean here.