

Evolution of the National Institute of Nursing Research logic model for center sustainability

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ABSTRACT

Background: Logic models are tools to evaluate the effectiveness of programs. In 2013, the National Institute of Nursing Research (NINR) *Logic Model for Center Sustainability* was developed.

Purpose: The purpose of this paper is to describe the process of revision and implementation of the NINR *Logic Model* across a continuum of NINR Exploratory Centers and Centers of Excellence.

Methods: The process for incorporating common data elements for symptom, self-management, biomarker science and precision health in the logic model is outlined. Information about the NINR *Logic Model* was gleaned from the National Institutes of Health Reporter, annual NINR Center Directors meetings, and from individual Center Directors.

Findings: Centers utilized the model for funding applications and to guide Core administration, evaluation, Center sustainability, and/or other Center metrics.

Discussion: The revised NINR *Logic Model for Center Sustainability* can be a useful tool for planning and implementing center activities for center impact and sustainability.

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Introduction

Collaboration and leveraging of resources was the focus of the 2013 National Institute of Nursing Research (NINR) Center Directors Meeting from which the elements of a logic model (LM) for center sustainability, leveraging resources, and collaboration were identified. Center funding, which began more than 25 years ago, has supported NINR

strategic science areas including symptom science, self-management, wellness and the underserved, and end-of-life care. Between 2012 and 2016 there were seven developmental (P20) and nine core (P30) Centers of Excellence funded by NINR, which focused primarily on symptom science, self-management, and self-management of symptoms (Table 1). The Centers provide infrastructure and support for cross-disciplinary collaborations using a team approach to accelerate science in their

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¹ Center Directors who participated in revision (Table 2).

Table 1 – NINR Centers Funded Between 2012 and 2016

Center	Grant Number	Funding Period	Principal Investigator(s)	Center Name	Institution	Website
P30	NR014129	2012–2017	Dorsey, Susan G.	Center to Advance Chronic Pain Research	University of Maryland, Baltimore	http://www.umaryland.edu/cacpr/
P30	NR014131	2012–2016	Page, Gayle & Smith, Michael T.	Center for Sleep-Related Symptom Science	Johns Hopkins University	https://nursing.jhu.edu/faculty_research/research/centers/sleep/index.html
P30	NR014134	2012–2017	Waldrop-Valverde, Drenna	Center for Neurocognitive Studies	Emory University	http://www.nursing.emory.edu/cns/
P30	NR014139	2012–2017	Docherty, Sharron & Bailey, Donald	Center for Adaptive Leadership in Symptom Science	Duke University	http://nursing.duke.edu/centers-and-institutes/adapt/adapt-center
P30	NR015326	2014–2019	Moore, Shirley	SMART Center II Brain- Behavior Connections in Self-Management Science	Case Western University	https://nursing.case.edu/research/centers/smart/
P30	NR015335	2014–2019	Kim, Miyong	Center for Transdisciplinary Collaborative Research in Self-Management Science	University of Texas, Austin	http://nursing.utexas.edu/tcrss/
P30	NR016579	2016–2021	Dorsey, Susan; Renn, Cynthia, & Resnick, Barbara	Omics Associated with Self-Management Interventions for Symptoms (sOASIS) Center	University of Maryland, Baltimore	http://www.nursing.umaryland.edu/research/research-centers/oasis/
P30	NR016585	2016–2021	Ward, Teresa & Heitkemper, Margaret	Center for Innovation in Sleep Self-Management	University of Washington	https://nursing.uw.edu/research/programs/sleep-research/
P30	NR016587	2016–2021	Bakken, Suzanne & Hickey, Kathleen	Precision in Symptom Self-Management (PriSSM)	Columbia University	http://nursing.columbia.edu/research/precision-symptom-self-management-prissm-center
P20	NR015320	2014–2019	Guthrie, Barbara	Northeastern Center for Technology in Support of Self-Management and Health	Northeastern University	http://www.northeastern.edu/nucare/
P20	NR014126	2012–2017	Redeker, Nancy S., & Yaggi, Henry	Yale Center for Sleep Disturbance in Acute and Chronic Conditions	Yale University	http://sleep.yale.edu/yale-center-sleep-disturbance
P20	NR015331	2014–2019	Barton, Debra, & Dinov, Ivo	Center for Complexity and Self-Management of Chronic Disease (CSCD)	University of Michigan	http://www.socr.umich.edu/CSCD/
P20	NR015339	2014–2019	Schiffman, Rachel	Self-Management Science Center at University of Wisconsin	University of Wisconsin, Milwaukee	https://uwm.edu/nursing/about/centers-institutes/self-management/
P20	NR016605	2016–2021	Starkweather, Angela	Center for Accelerating Precision Pain Self-Management	University of Connecticut	http://painresearch.uconn.edu/capps-m/
P20	NR016575	2016–2021	Kelechi, Teresa	Symptom Self Management Center	Medical University of South Carolina	http://academicdepartments.musc.edu/nursing/initiatives/researchoffice/ssmc.htm
P20	NR016599	2016–2021	Jacelon, Cynthia	UManage Center for Building the Science of Self-Management	University of Massachusetts, Amherst	https://www.umass.edu/nursing/UManage-Center

specialized areas. Centers also expand research capacity by providing training opportunities for students, postdoctoral fellows, and junior research faculty (Dunbar-Jacob, McCloskey, Weglicki, & Grady, 2014; Grady, 2009; Moore et al., 2016).

In order to support Center sustainability and evaluate Center activities, the NINR Center Directors developed a LM. LMs are tools used by program evaluators, funders, and managers, to evaluate the effectiveness of a program. These models are usually used for planning and implementation phases of a project, such as a center. LMs depict logical relationships between inputs (resources), outputs (products), outcomes (goals), assumptions (constants), and external factors (facilitators and barriers) of a program (Dorsey et al., 2014). LMs have been used in various areas of program evaluation such as educational programs, extension programs, and the National Institutes of Health (NIH) funded Clinical and Translational Science Award Program (Eder, Carter-Edwards, Hurd, Rumala, & Wallerstein, 2013; Schneider et al., 2015; Scott et al., 2014; Washington University, 2016).

The original components of the LM were derived from the presentations and discussions that occurred at the 2013 Center Directors Meeting. The speakers and discussions at the 2013 meeting, including breakout sessions, were focused on leveraging resources and increasing cross-disciplinary and cross-center collaborations to achieve sustainability of infrastructure to support science. After the meeting, Center Directors met via teleconferencing twice a month to discuss a paper that would best summarize the meeting. The writing team for the first LM paper (Dorsey et al., 2014) reviewed the summary and reports from three breakout sessions (collaboration, sustainability, and resource leveraging) to construct the LM. Content from subsequent NINR Center Directors Meetings that focused on common data elements (CDEs), biomarkers, and precision health were used to inform the current iteration of the LM. Thus, the purpose of this paper is to present and update the NINR LM for Center Sustainability and to describe current and future use of the NINR LM within the NINR Centers.

Methods

The NINR-funded Center Directors meet annually to discuss timely topical areas that would enhance Centers' functions, collaboration, sustainability, and/or scientific areas. During the 2014 to 2017 meetings, Center Directors discussed the development of CDEs for symptom, self-management and biomarker science, and the integration of precision health. In 2014, symptom CDEs were robustly discussed and through a collaborative and iterative process, CDEs for symptom science were developed (Redeker et al., 2015). The

Table 2 – NINR Center Directors Who Participated in Logic Model Revision (Center Directors Listed in Alphabetical Order)

Drs. Suzanne Bakken and Kathleen Hickey, Columbia University
Drs. Debra Barton and Ivo Dinov, University of Michigan
Drs. Sharron Docherty and Donald "Chip" Bailey, Duke University
Drs. Susan G. Dorsey, Cynthia Renn and Barbara Resnick, University of Maryland, Baltimore
Dr. Barbara Guthrie, Northeastern University
Dr. Cynthia Jacelon, University of Massachusetts
Dr. Teresa Kalechi, Medical University of South Carolina
Dr. Miyong Kim, University of Texas
Dr. Shirley Moore, Case Western Reserve University
*Dr. Susan Pressler, Indiana University
Dr. Nancy S. Redeker and Henry Yaggi, Yale University
Dr. Rachel Schiffman, University of Wisconsin-Milwaukee
Dr. Angela Starkweather, University of Connecticut
Drs. Teresa Ward and Margaret Heitkemper, University of Washington
Dr. Drenna Waldrop-Valverde, Emory University
*Dr. Lani Zimmerman and Dr. Bunny Pozehl, University of Nebraska

* Director of Center funded before 2012.

Center meeting in 2015 focused on CDEs for self-management science (Moore et al., 2016). Biomarkers in symptom and self-management science were the focus of the 2016 NINR Center Directors Meeting (Page et al., 2018). The focus of the 2017 meeting was on precision health.

To gain a more thorough understanding of the use of the LM in NINR Centers, a search was conducted in the NIH research portfolio online reporting tools and expenditure results tool data base, which is freely open to the public. In addition, information was gleaned from Center posters at the 2017 NINR Center Directors Meeting and discussion with current Center Directors. For example, discussions included whether Centers used the LM in their NIH grant application as a tool for evaluation and consistency of Center activities. For the current revision of the LM, both past and present Center Directors who are listed in Table 2 had opportunities to comment on the LM.

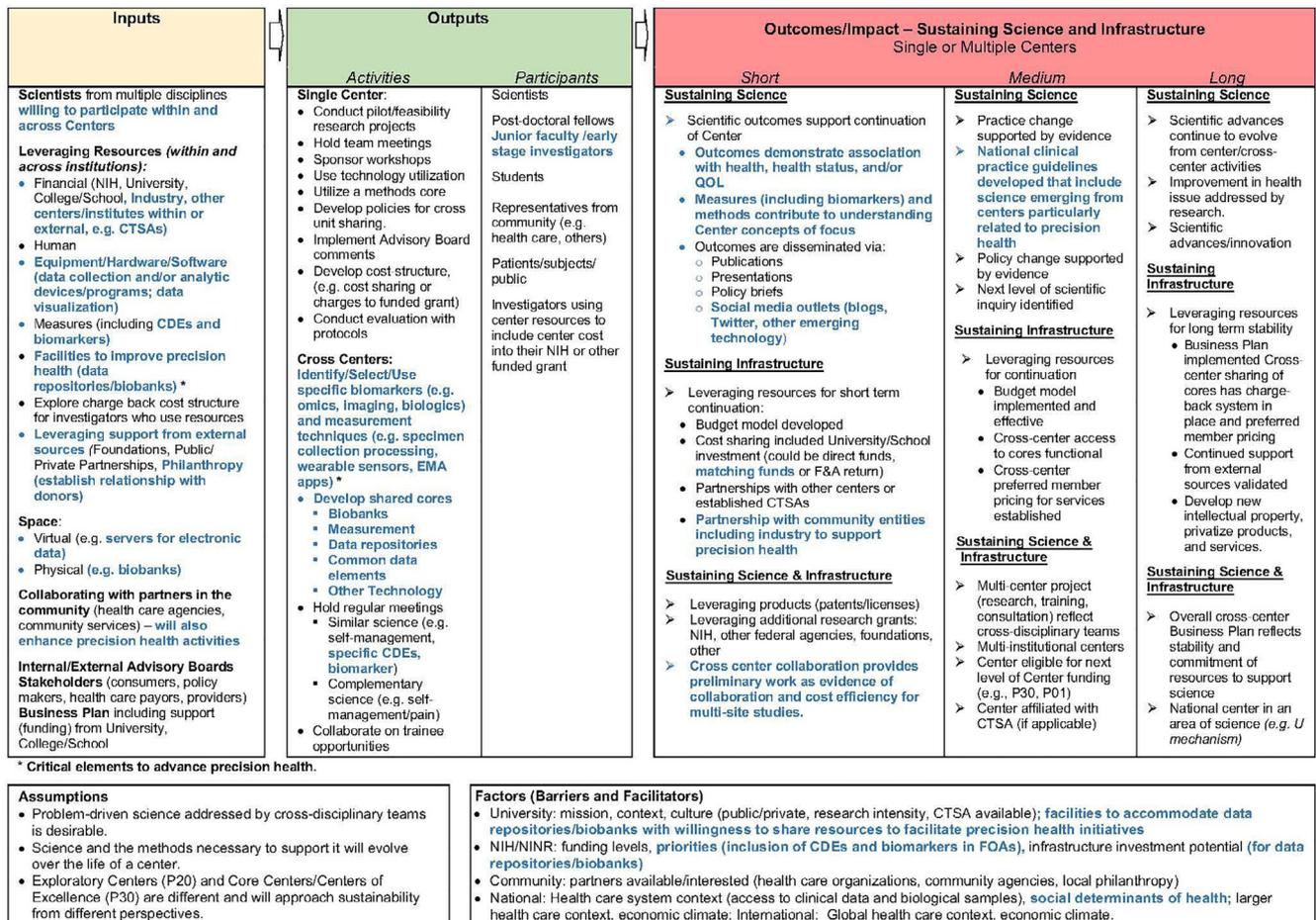
Findings and Discussion

Revisions to the LM

The updates that were incorporated into the revised LM as a result of the discussions during the Center Directors' meetings are described below and are reflected in Figure 1, bolded in blue.

External Factor (Barriers and Facilitators)

Each external factor included in the LM can be a barrier or a facilitator for a center depending on the congruence of the external entities with the goals and



* Critical elements to advance precision health.

Figure 1 – NINR logic model for center sustainability (revised). Revisions are in bold blue text.

objectives of the center. All of these elements should be evaluated for the extent of support for activities of a center or for cross-center collaborations. To this point, CDEs, biomarkers, and precision health were added to this section for consideration by those planning or managing centers. Universities may or may not have facilities to accommodate data repositories or biobanks. If those facilities exist, the willingness of universities to share facilities and resources with other institutions can advantage or disadvantage a center's sustainability or competitiveness. In the 2015 and 2017 Center funding announcements, NINR required the use of NINR CDEs for symptom and self-management science. Institutes and/or centers at NIH may recommend or require inclusion of CDEs and/or biomarkers in funding opportunity announcements. With the increased interest across NIH for national networks (National Institutes of Health, n.d.), center investigators need to be prepared to respond to these recommendations and requirements in funding applications. The availability and accessibility of clinical data from electronic health records and other data sources in health care systems must be considered, especially in the context of precision health since these data are frequently central to the research and health of individuals.

Inputs

Modifications of the inputs section incorporate aspects of CDEs, biomarkers, and precision health. Because of the emphasis on team science and the use of biomarkers, CDEs, and precision health, the content was reworded to reflect this update (Kneipp et al., 2014; Little et al., 2017). The ultimate goal is to increase and improve cross center collaborations (McBride, Watman, Escobedo, & Beilenson, 2011). The element of leveraging resources was broadened to include consideration of other sources from the inception and planning of a center. For example, industry partners, data visualization, and newer technologies are examples of ways to support CDE collection. Financial support from other resources could be used to supplement center funding and should be considered. Institutions with Clinical and Translational Science Awards may be good sources of supplementary and/or complementary funding. Industry was specifically added as a source not commonly considered but that may provide material resources for some centers. The element of equipment was broadened to include hardware and software that may be related to the collection, storage, analysis, and visualization of data for cross center collaboration. As an example, Research Electronic

Data Capture is a secure web application for building and managing online surveys and databases (<https://projectredcap.org/about/>). Measures of CDEs and biomarkers were specifically added to highlight the emphasis on these as critical elements to advance precision health. Common measures provide the foundation for data aggregation and analysis across studies, thus increasing the statistical power for comparisons across populations and sub-group analyses as well as the adaptability and reproducibility of findings. Facilities for data repositories and biobanks were specifically added to highlight emphasis of these resources for precision health. Not every center will need to have a repository or biobank but should seek to partner with one or more centers that do support these facilities. The costs for access can and should be included in the budget plan for the center. Philanthropy has not generally been considered as a source of support or leveraging of resources; however, cultivating donors with interests in the focus of the center may yield powerful results. For example, local foundations may partner with universities and centers focused on initiatives such as pain management. Space for storage of CDE data and specimens must be considered from the beginning to allow for adequate collection, maintenance, and distribution. NINR has developed a data repository for the support of CDE data called “Common Data Repository for Nursing Science” (<http://ninr-public-prod.cit.nih.gov/>).

Outputs

Cross-center collaborations was one element suggested for amplification in the LM because of its importance to the advancement of the science. Using common and consistent data elements across centers provides a base for combining data across smaller studies to refine measures and techniques and add power to secondary analyses. Careful consideration should be given to identifying centers where there is expertise in specific biomarkers, measures, or other technology to be lead centers in the development of shared cores. Junior faculty and early stage investigators were specifically added to ensure that the next generation of scientists is targeted for inclusion in center activities.

Outcomes and Impact

The short-term outcomes and impact section was significantly broadened to include health related concepts, measures of those concepts, and venues for dissemination beyond the traditional approaches. Industry was specifically added as a potential community partner for short-term sustainability of infrastructure. The gains from cross-center collaborations were specifically identified for sustainability of both science and infrastructure in the short-term. For sustaining science for medium term impact, the inclusion of the knowledge derived from center research should inform national practice guidelines, for example, those

from the American Heart Association for centers focused on management of chronic cardiovascular conditions. The commitment of resources was included as a critical factor in the stability of a center and in sustaining science and infrastructure in the long term.

Current and Future Directions for Application of the LM in NINR Centers

As of 2016, there were 16 NINR funded Centers (Table 1). Of those, nine were P30s and seven were P20s. Only the Centers funded in 2016 had access to the Dorsey et al. (2014) article to use as a guide in the development of their grant applications. Tables 3 and 4 summarize the discussion with the 15 funded Centers who participated in the writing of this paper. Center Directors also discussed the use of the LM in their original NIH grant applications for funding, to guide center activities, and for center evaluation. Of the 10 Centers funded prior to publication of the LM in 2014, most were using components of the LM in their Center activities and for Center evaluation. Of the six Centers funded in 2016, the majority used the model in the preparation of their NIH grant application. During discussions, several examples of the use of the LM were mentioned. For example, the Precision in Symptom Self-Management Center (Columbia University), used the components of the LM as the organizing framework for writing the approach section of the administrative core with elements of the LM explicitly described for operationalization in the center. Expected outcomes from the LM formed the basis of the evaluation plan. Another Center at the University of Washington was explicit in how the LM was a guide to making the connections between the inputs, outputs, and outcomes from the center. At the University of Wisconsin—Milwaukee, they indicated:

“We used the LM to carefully plan the Center activities that we knew would be required to be successful based on our past experience. We then made sure we had the right inputs to support those activities. We also carefully identified our expected outcomes. We tied the LM to our Center aims and to the evaluation plan”

At the University of Maryland, Baltimore, the multiple principal investigator team of the Omics Associated with Self-Management Interventions for Symptoms Center used the model in the grant application to guide the evaluation plan and also to ensure center sustainability:

“We use the Logic Model for both evaluation and sustainability. Each quarter, the internal executive committee (IEC) reviews progress, and then the LM guides the annual external scientific advisory committee (ESAC) review. In terms of sustainability, there are specific benchmarks that are measurable”.

Table 3 – Aspects of NINR LM Use in NINR P30 Centers of Excellence

Center Name	Institution	Year Funded	Logic Model Used in Application?	Center Activities Consistent with Logic Model?	Logic Model Used in Center Evaluation?
Center to Advance Chronic Pain Research	University of Maryland, Baltimore	2012	N/A	N	N
Center for Sleep-Related Symptom Science	Johns Hopkins University	2012	N/A	N	N
Center for Neurocognitive Studies	Emory University	2012	N/A	N	Y
Center for Adaptive Leadership in Symptom Science	Duke University	2014	N/A	Y	Y
SMART Center II Brain Behavior Connections in Self-Management Science	Case Western Reserve University	2014	N/A	Y	Y
Center for Transdisciplinary Collaborative Research in Self-Management Science	University of Texas, Austin	2014	N/A	N	Y
Center for Innovation in Sleep Self-Management	University of Washington	2016	Y	Y	Y
Omics Associated with Self-Management Interventions for Symptoms (OASIS) Center	University of Baltimore, Maryland	2016	Y	Y	Y
Precision in Symptom Self-Management (PriSSM)	Columbia University	2016	Y	Y	Y

Table 4 – Aspects of NINR LM Use in NINR P20 Exploratory Centers: Building Research Teams of the Future

Center Name	Institution	Year Funded	Logic Model Used in Application?	Center Activities Consistent with Logic Model?	Logic Model Used in Center Evaluation?
Yale Center for Sleep Disturbance in Acute and Chronic Conditions	Yale University	2012	N/A	Y	Y
Center for Complexity and Self-Management of Chronic Disease (CSCD)	University of Michigan	2014	N/A	Y	Y
Northeastern Center for Technology in Support of Self-Management and Health	Northeastern University	2014	N/A	Y	Y
Self-Management Science Center at UWM	University of Wisconsin-Milwaukee	2014	N/A	Y	Y
UManage Center: UMass Center for Building the Science of Symptom Self-Management	University of Massachusetts	2016	N	Y	Y
Center for Accelerating Precision Pain Self-Management	University of Connecticut	2016	Y	Y	Y
The Symptom Self-Management Center	Medical University of South Carolina	2016	N	N	N

Centers where the LM was used to guide activities of the Center indicated that:

“...We are using it at every monthly meeting to guide our decisions and next steps.”

“...It guided our inputs particularly in the area of leveraging resources.”

“...We review both the LM and the evaluation plan periodically at the meetings of the Center Executive Committee - to identify if we are operating according to expectations or whether we need to make adjustments.”

“...The Executive Committee puts our evaluation as an agenda item quarterly. We then use the Logic model - inputs, outputs, and outcomes/impact for discussion of

setting priorities for the Center. We find it helpful to stay on track the big picture and what we are concentrating on”

Even in centers not using the LM, there was examination of the potential, as expressed by the following: “...we are examining the real implications of the Logic Model and exploring it for potential applications in pilot studies.”

Those Centers that have the longevity to be able to address the usefulness of the LM for evaluation found the LM to have positive and potentially challenging areas. This was best expressed in the following:

“The outcomes - many are the usual scientific productivity measures that we have always kept. The toughest part of the model is its emphasis on sustainability...so we are on the lookout for other funding. Funding is hard, however, to get today - the school has little funds to invest (as like most schools, the budgets are very tight) and foundation funding is very competitive - mostly with other units of the University going for some of the same funding. Having it in the logic model does help, however, to keep sustainability in the forefront and keep discussions going with our dean and University Development Dept.”

Another important aspect that exemplified the challenges that may require additional discussion was:

“The other area that has been hard to operationalize on the Logic Model is the cross-center activities. I feel that this should be one of the most fruitful activities for the Centers to advance knowledge in an efficient way and yet there remains relatively little cross-center sharing and activities. Is it because we are basically in competition for the same dollars for future funding? Are we just now organized in that way? As leaders of Centers, we are some of the busiest nursing scientists, so the lack of incentives to collaborate/share more reduces our efforts in this regard. I definitely feel this is a lost potential and am wondering how we can get incentives in place for more collaboration.”

In 2017, the NINR published funding announcements soliciting applications for centers (P20 and P30) and indicated:

“The Evaluation Plan should include...an annual evaluation of Center success, based on the NINR Logic Model of Sustainability as outlined in the published NINR Centers of Excellence: A logic model for sustainability, leveraging resources and collaboration to accelerate cross-disciplinary science (Dorsey et al., 2014).”

Many Centers utilized the previous version of the LM to develop their grant applications and to guide either core administration, the evaluation plan, Center sustainability, or in combination with other Center metrics. The LM provided operational structure and a roadmap for cohesive, carefully planned Center

activities and, importantly, collaboration and sustainability metrics. In addition, the NINR Center Directors found that the LM was important for use as a framework and tool for evaluation, within a Center and potentially, across Centers. As Centers apply the LM, more information about the usefulness for describing outcomes of Center will be disseminated. For example, the Center at Northeastern University used the LM for Center evaluation (Lees et al., 2018). This dissemination will allow a robust synthesis of the impact of the LM on the sustainability of the NINR Centers.

Conclusion

This paper provided an update of the LM originally published in 2014. The most important updates included the addition of precision health, the use of CDEs, and proposed biomarkers for symptom and self-management science. As with the earlier version of the LM, it will be important for the Center Directors and NINR to monitor the use and usefulness of the revised LM to ensure that it evolves to match the scientific emphases and required support for sustainability across the NINR Centers Program.

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