Successful Self-Directed Lifelong Learning in Medicine: A Conceptual Model Derived From Qualitative Analysis of a National Survey of Pediatric Residents

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Abstract

Purpose
Self-directed lifelong learning is integral to medical professionalism, yet how best to encourage its development during clinically intensive training is unknown. The authors develop a model for successful self-directed learning by analyzing qualitative data from a national survey of residents.

Method
Pediatric and medicine/pediatric residents at 46 training programs completed a Web-based survey in 2008–2009. Self-reported barriers to and strategies for achieving self-directed learning goals were systematically analyzed through inductive iterative review.

Results
A total of 992 out of 1,739 (57%) residents responded. Barriers to achieving self-directed learning goals were categorized into *difficulty with personal reflection*, *environmental strain*, *competing demands*, *difficulty with goal generation*, and *problems with plan development and implementation*. Strategies for achieving learning goals included creating goals that were *important* (relevant to the learner and prioritized by the learner as important to achieve), *specific* (with broad goals broken down into incremental steps and a specific plan for each step), *measurable*, *accountable* (with reminder and tracking systems and building in internal and external accountability), *realistic* (achievable goals which utilize existing opportunities and constant self-adjustment), and included a *timeline* for completing the goal (and incorporating the goal into their daily routine).

Conclusions
On the basis of the data, the authors propose a conceptual model for self-directed lifelong learning involving creation of learning goals and plan development based on individual reflection and self-assessment, and continual revision of goals and/or plans based on degree of goal attainment. This model could be broadly applicable throughout medical education.

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Self-directed lifelong learning is an integral component of medical professionalism.[1–3] The concept that "physicians must be committed to lifelong learning" was described in a physician charter[1,2] endorsed by over 120 national and international organizations.[3,4] In addition, documentation of self-directed lifelong learning is now required for residency training, board certification, and maintenance of certification in many countries.[5,6] To foster the development of self-directed learning skills, many medical schools have replaced lectures with more problem-based learning activities during preclinical training.[7] Although some evidence indicates that these approaches may foster self-directed learning,[8,9] little is known about how to further develop these skills during the clinical years of medical school and during graduate and continuing medical education. To address this issue, the Review Committee for Pediatrics of the Accreditation Council for Graduate Medical Education now requires all pediatric residency programs to use individualized learning plans (ILPs) to document and encourage residents' self-assessment and self-directed learning.[10]

ILPs require residents to assess their own learning needs, create learning goals, and document progress toward achieving these goals. Although the use of ILPs intuitively makes sense, little is known about how best to use them and what factors are associated with achievement of learning goals. Previous studies of ILPs have been limited to single institutions, with no formal analysis of barriers to and strategies for achieving learning goals.[11–13] Our study seeks to identify and categorize barriers to and strategies for achieving self-directed learning goals from a national sample of pediatric and medicine/pediatric residents and to use this information to develop a conceptual model for successful self-directed learning during clinical training. This is important because it could provide educators with critical information about how to better develop and support lifelong learning skills across the entire continuum of medical education.

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Method

Data collection

We performed a national, cross-sectional, Web-based survey of pediatric and medicine/pediatric residents in 2008–2009. Program directors were recruited to participate in this study at the 2008 Association of Pediatric Program

Directors (APPD) annual spring meeting, as well as through the APPD listserv. Program directors participated in the study either by recruiting their own residents to participate (this first option required local institutional review board [IRB] approval) or by sending the study's principal investigator (S-T.T.L.) the e-mail addresses of residents in their training program (this second option fell under the principal investigator's IRB application). The number of potential responses was defined as the number of residents listed in each program's IRB application or the number of live e-mail addresses from each program. Recruitment letters with the Web-based survey link were emailed to residents, and reminders were sent every two weeks until the close of the survey. Residents were considered to have completed the survey if two or more of the survey questions were completed. As incentive for participation, one responding resident from each program was chosen at random to win a small cash prize.

The survey included demographic information and questions about residents' experiences with ILPs. Residents who had previously written at least one ILP were asked to identify (1) barriers to achieving their learning goals, and (2) strategies for achieving their learning goals.

The IRB at the University of California, Davis, approved this study. A total of 46 pediatric training programs (23% of a possible 196 programs) participated in the study; 13 programs selected the first option and received IRB approval at their site.

Analysis

Responses to the two open-ended questions were systematically analyzed through inductive iterative review by two coders (S-T.T.L., D.A.P.). The analysis involved four phases: *organization* of existing data, *categorization* of repetitive or redundant patterns, *generalization* into recurring themes, and *external review*.

Responses were put into an Excel spreadsheet to facilitate comparative coding (*organization*). Coding categories and related themes emerged through iterative review of residents' responses to the open-ended questions. Each coder reviewed each response and noted the predominant and recurrent themes in residents' characterizations of barriers to and strategies for overcoming barriers to achieve their learning goals (*categorization*). For an item to be included in the analysis, it had to be identified by at least two residents. Emerging themes were discussed until consensus was reached about those that provided the most parsimonious and illustrative interpretation of the data.

Similar responses were organized into categories, and like categories were grouped into broader themes (*generalization*). Some responses contained more than one theme. A third, external reviewer (D.C.W.) independently examined the uncoded data and reviewed the themes and categories derived by the two coders for accuracy and exhaustiveness (*external review*). All coders developed consensus regarding salient categories for coding based on the data and its relevance to developing and using ILPs in resident training.

Results

Participating institutions and residents

The response rate was 57% (992/1,739). Residency programs included pediatric and combined pediatric programs (e.g., medicine/pediatrics, pediatric psychiatry) from all geographic regions in the United States: Northeast (13), South (12), Midwest (9), and West (12).

Residents from all pediatric postgraduate years responded to the survey: 36% of first-year residents, 34% of second-year, and 30% of third-year or higher. Participants were from various size programs: 26% from small programs ($\leq$30 residents), 40% from medium programs (31–60 residents), and 34% from large programs ($>$60 residents). They were predominantly female (74%); 44% indicated an interest in pursuing a subspecialty, whereas 13% were undecided. The demographic distribution of survey participants reflects those of all U.S. pediatric residents in terms of postgraduate year distribution (35% first-year, 33% second-year, 32% third-year), program size (23% small program, 46% medium program, 31% large program), gender (73% female), and subspecialty interest (48%).[14]

Of the 992 participating residents, 772 (78%; 44% of all eligible residents) had participated in the ILP process before completing the survey and, therefore, completed an additional set of open-ended questions regarding their experience with the process. Table 1 shows similarities in demographic characteristics between study participants who completed an ILP and all participating residents.

Thematic analysis

Barriers to achieving learning goals. Five themes emerged that characterized barriers to achieving learning goals: *difficulty with personal reflection*, *environmental strain*, *competing demands*, *difficulty with goal generation*, and *problems with plan development and implementation*. Examples of responses supporting these themes are shown in Table 2.

The theme of *difficulty with personal reflection* was composed of problems with introspection (e.g., difficulty assessing one's weaknesses) and the existence of personal traits that made goal achievement and assessment of progress toward one's goal more difficult. For example, some residents noted aspects of their own behavior and attitudes, such as "apathy," "procrastination," and "fear of failure" that inhibited the accomplishment of goals.

Environmental barriers consisted of external factors, often program-based, such as stress, tiredness, time pressures, and erratic schedules, over which residents claimed little or no control. For example, many residents noted that they felt "constantly tired" and stressed because of the "hectic lifestyle of residency." Time pressures from duty hours requirements did not permit "enough time in a 24-hour period" to do everything. This led to the perception that there was a "lack of dedicated time during rotations to work on administrative goals." Other program-based factors included inconsistent daily schedules due to unpredictable patient care demands and frequently changing rotations, making consistent follow-through on learning plans difficult.

A third category emphasized *competing demands*, which required balancing the effort to meet patient care needs with making progress toward learning goals and attending to life outside of residency. Residents were keenly aware that they

Table 1

Demographic Characteristics of 992 Residents in Pediatric Medicine, Including 772 Residents Who Had Previously Completed an Individualized Learning Plan (ILP), 2008–2009*

Characteristic	All participants, no. (%)	Previously completed ILP, no. (%)
Female	598 (74)	458 (74)
Postgraduate year		
First-year	284 (36)	172 (29)
Second-year	270 (34)	232 (39)
Third-year or higher	239 (30)	198 (33)
Size of residency program		
Small	257 (26)	185 (24)
Medium	401 (40)	365 (48)
Large	334 (34)	218 (28)
Subspecialty interest		
Generalist	346 (44)	273 (45)
Subspecialist	339 (43)	262 (43)
Undecided	105 (13)	69 (11)
Practice setting interest		
Academic	335 (41)	256 (42)
Community	265 (33)	212 (35)
Undecided	208 (26)	146 (24)

* Demographic questions were at the end of the survey, and not all respondents completed the entire survey.

needed to balance the "pressing issues of day-to-day work and patient care" and the amount of information and skills they needed to acquire. Even those residents who had a routine to integrate their learning goals into their daily activities felt disrupted by "unexpected emergencies when on service [which forced me] to reprioritize my usual routine." Additional residency requirements—morning reports, conferences, and logging procedures—were often seen as interfering with patient care and learning. One common related subtheme was difficulty in maintaining life–work balance, including "balancing work and family." As a result, some reported drawing a sharp line between work and home.

A fourth category of barriers involved *difficulty with goal generation*. Residents described concerns over the number and content of their learning goals. Many expressed worry over "setting too many goals," "goals [which needed to be] change[d] or need[ed] to be modified often," and setting goals that were not personally important. Residents realized that broad or lofty goals were more difficult, if not impossible, to achieve. In addition, one resident responded, "[I have] uncertainty in how to convert a specific proficiency area or skill set into a real world goal, especially given the somewhat nebulous definitions of the areas of proficiency." Some even responded that the ILP format or concept itself did not fit their learning needs. One resident referred to the deficits in ILP this way: "My real deficits and goals weren't really addressed in the standard ILP format." Another noted that "having a structured plan is not useful in this type of learning—learning as you go (such as reading about a current patient) is MUCH more helpful."

A fifth category of barriers centered on *problems with plan development and implementation.* Problems with plan development included "not having a specific plan" to accomplish a goal or "[not] know[ing] all the resources available for learning." This was made more difficult when goals did not include a measurable outcome. Residents commented that "goals that were not physically trackable were more difficult to work toward." Although some residents felt "reluctant to ask for help," many would have appreciated more specific mentorship. One resident commented, "Although I created strategies, it would have been nice to get more input from the residency program or my advisor on suggestions for more efficient approaches to my goals." Problems with plan implementation included few opportunities to put the initial plan into effect and difficulty considering alternatives when the original plan could not be carried to completion. Residents remarked on lacking "opportunity to do procedures" and "not seeing [specific kinds of] patients for a given goal." Some found that it was difficult to remember to work on their learning goal because they would often "forget that [they] have a learning plan."

Strategies for achieving learning goals. Residents identified various strategies that they used to achieve their learning goals. These strategies reflect residents' understanding (as well as an analytical pragmatism) that some barriers are nonremediable, given the programmatic structure of medical education. We classified strategies for achieving learning goals into the following broad categories: *important*, *specific*, *measurable*, *accountable*, *realistic*, and *timeline*. Table 3 outlines these strategies, means for achieving them, and example statements from residents that support them.

Choosing goals that residents thought were *important* to their development was one strategy for success. An important goal was one that residents characterized as relevant and of higher priority than other goals or competing demands. For most residents, relevance was described as something that fit with their intended outcomes of residency training. For example, one resident stated, "[t]hinking about what I wanted at the end of my residency training and work[ing] towards it." Another was even more specific, focusing on "choosing goals that I am currently already working on." Consciously making a choice to focus on their designated learning goal was another important strategy. One resident made "a conscious choice to achieve the goals," while another indicated that "prescheduling time to focus on my goals" ensured their accomplishment.

Making goals *specific* enough to be accomplished was another important strategy for achieving learning goals. Some residents noted that breaking

Table 2

Barriers to Achieving Learning Goals, as Expressed by 772 Residents in Pediatric Medicine Who Had Previously Completed an Individualized Learning Plan (ILP), 2008–2009

Barriers and subcategories (no. of responses)	Examples
Difficulty with personal reflection	
Self-identified personality-based traits (57)	• "Some challenges based on habit" • "Hard-set maladaptive past learning strategies" • "All my goals were set about overcoming my natural weaknesses/tendencies, so my very personality was my biggest barrier" • "Lack of confidence" • "Fear of failure" • "Procrastination" • "Lack of motivation" • "Apathy"
Environmental strain	
Tired and stressed (73)	• "Being constantly tired" • "Exhaustion after a day's work or being on call" • "Finding the time to read when I'm not too tired that I can actually remember what I read" • "High-stress environment" • "Surviving the intern year"
Time pressures (250)	• "My work schedule was a huge barrier to my having time to study. I actually took a week of conference time to study because my schedule was not conducive to meeting my goals on time." • "Not enough reading time during the rotation" • "Limited time of a resident" • "Lack of dedicated time during rotations to work on administrative goals" • "Time restrictions from work hours"
Erratic schedule (31)	• "Changing rotations often so that some skills are used infrequently" • "Erratic schedule" • "[Difficulty] coordinating study sessions with other residents on different rotations"
Competing demands	
Patient care–learner balance (108)	• "More pressing issues of day-to-day work and patient care" • "So much to learn as an intern" • "Silly activities that are required with no educational value" • "Other goals and projects get in the way"
Life–work balance (41)	• "Balancing work and family" • "When I'm home I want to do other things." • "Desire to succeed at other aspects of your life besides medicine (living a diverse life)"
Difficulty with goal generation and plan development and implementation	
Difficulty with goal generation (28)	• "Not all goals were significant to me." • "Goals change or need to be modified often." • "Lack of specificity in goals/objectives" • "Goals are sometimes too broad or set too high to accomplish quickly." • "Choosing goals that were too broad in scope" • "Underestimating time commitment required to reach goals" • "Choosing goals that … required more interaction/input from other people" • "My real deficits and goals weren't really addressed in the standard ILP format."

(*Continues*)

broader goals into incremental steps, or "establishing short-term goals in addition to long-term aims," was an effective strategy that allowed for breaking general goals into smaller, "doable" bits. Similar strategies included "hav[ing] realistic expectations" and establishing a "one step plan" and "work[ing] until [the goal's] done" before moving on to the next step.

Similar to making goals specific is the strategy of making goals *measurable*. This can be accomplished by identifying quantifiable or easily assessable outcomes. For example, many residents described setting "concrete endpoints," and attending to "goals that were readily available" as strategies for making goals measurable.

Linked to measurable goals was the idea of having a system that made residents *accountable* for making progress on learning goals. Strategies for accountability took the form of tracking systems, external accountability to faculty and peers, and internal accountability through self-reflection and evaluation. Residents noted that the most useful tracking systems involved "making lists and checking off items," "reviewing their ILP," and "writing goals" on calendars so that they would be in constant view. Most responses related to external accountability took the form of seeking regular advice and feedback from peers, faculty mentors, and advisors. Residents found it helpful to "talk to others to get a better, reasonable vision and how to accomplish it." One resident noted that "know[ing] that my attending knows about the goals, helped to outline the steps and will be keeping tabs," was a motivator to working toward goal achievement. Sharing their learning goals with others helped residents accomplish their goals by allowing "focused teaching from attending[s] and fellows regarding goals in clinical areas" and allowed residents to "share results of learning with medical students." Strategies for internal accountability frequently involved enlisting the assistance of others as external monitors in addition to "periodically reevaluating personal goals."

Establishing *realistic* goals involved creating achievable goals, seeking out and using available opportunities to help reach them, and being willing to adjust

Table 2
(*Continued*)

Barriers and subcategories (no. of responses)	Examples
Difficulty with plan development and implementation (75)	• "Not having a specific plan" • "Not having concrete goals or ways to measure outcome" • "Goals that were not physically trackable were more difficult to work toward." • "You don't know all the resources available to you for learning." • "Not seeing patients for a given goal or not encountering the situation" • "[No] opportunity to do procedures" • "Reluctance to ask for help; not knowing how to ask for evaluations" • "Forgetting that I have a learning plan" • "Not reminding myself consistently or not reviewing what my goals were" • "[Difficulty] fitting my goals into my daily schedule/responsibilities" • "Lack of urgency for completion"

them on the basis of perceived progress or lack thereof. Creating achievable goals meant creating "smaller, more attainable goals," "hav[ing] realistic expectations," and flexibility in "adjust[ing] of learning goals/priorities." Specific examples included "informing staff that I was interested in performing any procedure that needed to be done," "volunteering more," "being proactive looking for feedback," and "learning from [existing] cases" during rounds and morning report. Residents described methods to internally motivate themselves by "[seeking] periodic self-evaluation, peer and attending evaluations," "taking in-service exams [which] motivated me to study more," and "rewarding myself." For one resident, self-reflection and reframing resulted in "try[ing] to have a positive attitude when I am at work, and chang[ing] obstacles into learning opportunities."

The final broad strategy involved establishing a *timeline* for achieving goals and methods to incorporate goals into a daily routine. For some residents, developing a timeline meant "[establishing] specific deadlines," while for others it meant "making a schedule" or "making priorities for the daily 'to do' list." Successful residents were able to incorporate their learning goals into their daily routines. Residents noted "looking at ways to incorporate [my goals] in my day to day activity" and "having realistic goals that were already part of my regular learning plan/routine."

Conclusions

Our goal was to identify a conceptual model of self-directed learning that could be broadly applied to clinically intensive educational environments. To do this, we analyzed open-ended responses from a national survey of pediatric and medicine/pediatric residents who were asked to describe barriers to and strategies for achieving learning goals. We found that residents identified many learner-level and program-level barriers to achieving their learning goals. The most commonly identified barrier was competing demands, either from the "more pressing issues of day-to-day work and patient care" or balancing their lives outside of residency (e.g., "when I'm home, I want to do other things"). Another significant barrier was difficulty with goal generation and developing and implementing a plan to achieve those goals. For example, residents indicated that they were unlikely to make progress toward their goals if the goals were "too broad in scope" or not "significant" to them, or if there was no clear mechanism to achieve the goals. External environmental factors that created stress, exhaustion, or diminished time available to complete learning goals were also important. In most cases, training programs, rather than residents, are in a position to mitigate these factors.

Despite these barriers, many residents identified strategies that they used to achieve their goals. The most common strategy for success was choosing goals that were specific and relevant to the resident and prioritizing their efforts to work toward those goals, often by incorporating learning goals into the regular daily routine and learning activities. Complementing these strategies was accountability—either internally, by using a system to track progress (e.g., "making lists" or using a "personal calendar"), or externally, through a colleague or faculty mentor so that "someone else would also be monitoring" their progress.

Many of the barriers to achieving learning goals that we identified are consistent with those found in previously reported smaller, single-institution studies. For instance, medical students who were asked to incorporate their individual goals into a family medicine clerkship had difficulty creating their own learning goals and were more likely to pick from a menu of learning goals.[12] At the graduate medical education level, two different training programs that piloted the use of ILPs found that residents reported difficulty with reflection (e.g., ability to recognize own weaknesses, lack of motivation), environmental stress (e.g., insufficient time, tiredness), and difficulty with goal generation and plan development (e.g., insufficient understanding of how to construct an effective ILP and follow through, plan development).[11,13]

Difficulty with self-assessment has not been limited to medical students and residents. Studies of practicing medical professionals indicated that physician self-assessment did not reliably concur with external assessment, indicating that physicians have a limited ability to accurately self-assess.[15] These data, coupled with our findings, suggest that limitations in the ability to accurately self-assess create a potentially critical barrier to effective self-directed, lifelong learning at all levels of education—from undergraduate medical education through continuing medical education and potentially even maintenance of certification. Several of these same studies identified strategies for success that were similar to our findings, such as dedicating time, creating accountability, and helping with goal generation either through mentorship or relying more on external assessments than self-assessment.[13,15]

On the basis of our findings, we developed a conceptual model for

Table 3

Strategies for Achieving Learning Goals, as Expressed by 772 Residents in Pediatric Medicine Who Had Previously Completed an Individualized Learning Plan (ILP), 2008–2009

Strategy and subcategories (no. of responses)	Examples
Important	
Choose goals relevant to learner (35)	• "[Thinking] about what I wanted at the end of my residency training and worked towards it" • "Choosing learning goals that were important to me" • "Choosing goals that I am currently already working on *or* that are the obvious next steps based on my current position/stage of training"
Prioritize achievement of learning goals (124)	• "Making the goals priorities" • "Making a conscious choice to achieve the goals since I had taken the time to do the ILP" • "Prescheduling time to focus on my goals" • "Setting aside time each week to achieve the goal" • "Taking time out of my day to address those goals"
Specific	
Break broader goals into incremental steps (60)	• "Having specific goals instead of broad/generalized goals" • "Attacking a specific task or part of the goal rather than broad objectives" • "Establishing short-term goals in addition to long-term aims" • "Break[ing] the process down into smaller steps"
Plan how to accomplish incremental steps (35)	• "Do one step plan at a time. I set a goal then work on it until it's done, then I set another plan." • "Keep[ing] objectives in my mind while planning strategies and making sure the strategies are such that I can easily follow"
Measurable	
Set a measurable outcome (16)	• "[Making] concrete endpoints" • "[G]oals that were readily available and physically trackable were more easily met" • "Setting easily measurable goals was the best strategy!"
Accountable	
Use a reminder and tracking system (97)	• "Making lists of things to do and checking off items" • "Evaluat[ing] achievement at the end of the month" • "Reviewing the ILP" • "Writing goals onto my personal calendar"
Build in external accountability (73)	• "Knowing someone else would also be monitoring my progress" • "[Finding] a faculty mentor, other faculty, or program director who makes you accountable or asks you about your progress" • " I discussed with my advisor and with attendings the right strategies." • "Talking with my program director and mentors" • "Discussions with attendings" • "Talking to others to get a better, reasonable vision and how to accomplish it" • "[Getting] focused teaching from attending and fellows regarding goals in clinical areas" • "[Getting] program director encouragement [and] faculty involvement with plan" • "Knowing that my attending knows about the goals, helped to outline the steps and will be keeping tabs!"

(*Continues*)

lifelong learning that can be used in clinically intensive training environments (Figure 1). The process begins with reflection as individual learners work to establish achievable goals, initially in collaboration with a faculty mentor or in the context of a specific training program objective. Achieving learning goals requires a focused plan, the elements of which, based on our findings, can be organized into a modification of the **ISMART** (**I**mportant, **S**pecific, **M**easurable, **A**ccountable, **R**ealistic, and **T**imeline) paradigm previously described.[16,17] Following plan development and implementation, learners must assess their progress and, on the basis of that assessment, consider alterations in the plan, including alternative combinations of **ISMART** strategies. Goal achievement requires the development of a new set of goals, which cycles the learner back to individual reflection and goal development. Lack of achievement, even after employing contingency plans, requires that learners revise their goals to better reflect their interests, abilities, and immediate social context (e.g., programmatic and organizational strengths and opportunities). Although this model was derived from studying pediatric and medicine/pediatric residents, it could be adapted to apply to other types of physicians-in-training and even physicians who are participating in continuing education or maintenance of certification. For learners outside of formal training programs, mentorship could be substituted with other external sources of ongoing individual evaluation (e.g., consumer satisfaction reports, employer evaluations, chart audits) to provide feedback and measures of success.

We included only pediatric and medicine/pediatric residents in this study, so it is possible that learners from other disciplines (e.g., surgical subspecialties) or levels of medical education (e.g., medical students, practicing physicians) may encounter different or additional barriers to achieving their learning goals or use different strategies for success. However, none of our findings appear to be specific to pediatric education, and data from other, smaller, published studies in other fields of medicine and other levels of medical education are consistent with our findings. In addition, although our data suggest that residents may have difficulty with self-reflection, a

Table 3
(*Continued*)

Strategy and subcategories (no. of responses)	Examples
Establish internal accountability (10)	• "Periodically reevaluating personal goals" • "Making an effort to share my goals with attending on my rotations" • "Making sure that I ask when I have questions instead of trying to figure things out for myself" • "Making mentors aware of my goals" • "Asking for advice" • "Taking greater initiative with concepts/situations that intimidate me"
Realistic	
Create achievable goals (44)	• "[Creating] smaller, more attainable goals" • "Hav[ing] realistic expectations" • "Adjust[ing] of learning goals/priorities"
Seek out and use available opportunities (89)	• "Realizing the opportunity to make progress toward my goals" • "Learning from cases" • "Volunteering more" • "Being proactive looking for feedback" • "Forcing myself to try new procedures" • "Informing staff that I was interested in performing any procedure that needed to be done" • "Ask[ing] my interns if any questions about patients so I have chances to teach interns and med students"
Self-adjust (24)	• "[Seeking] periodic self-evaluation, peer and attending evaluations" • "Reflecting" • "Taking in-service exams motivated me to study more." • "Rewarding myself" • "I always try to have a positive attitude when I am at work, and to change obstacles into learning opportunities.
Timeline	
Develop timeline for achieving goals (32)	• "Making a daily time table" • "[Establishing] specific deadlines" • "Making a schedule" • "Making priorities for the daily to-do list"
Incorporate goals into daily routine (87)	• "Looking at ways to incorporate (my goals) in my day-to-day activity" • "Having realistic goals that were already part of my regular learning plan/routine" • "Trying to incorporate the goals into everyday habits" • "Making the goal a part of my routine" • "Reading about patients after I see them"

structured, Internet-based survey may not be the best context for demonstrating self-reflexive capacities. Other qualitative methods, such as in-depth, semistructured interviews with prompts, might allow better elaboration of responses and provide greater clarification of our findings. Nevertheless, our Web-based survey design offered distinct advantages in that it allowed us to conduct a large, multiinstitutional study and ensured consistency of question delivery and ease of data collection. And, because of the large number of responses from a nationally representative group of institutions and residents, we easily achieved saturation of themes in our analysis, and we feel confident, within the limitations of our response format, that our findings can be generalized at least across pediatric residents and training programs in the United States. Finally, our study design allows for ease of replication, making it possible to use the same method to explore similar questions in other populations of learners, such as medical students or surgical or family medicine residents.

Many of our findings have implications for program development across the continuum of medical education. For example, if learners are to develop and maintain effective, self-directed learning skills, training programs should include systems that help trainees to develop self-assessment skills (e.g., by providing opportunities for learners to compare self-assessment with external assessment), generate appropriate learning goals and plans to achieve them (based on the **ISMART** strategies), and provide tracking and monitoring systems to ensure accountability. This approach may require more structured opportunities for self-reflection (e.g., recording critical incidents before developing learning goals) and enhanced mentoring programs. Our findings also indicate that external environmental factors, many of which are inherent to the current structure of medical education and controlled primarily by training programs rather than trainees, need to be altered. Competing demands from patient care, life outside of residency, and a sense that self-directed learning activities "lack urgency" creates powerful barriers to residents attending to their own education. Although some of these conditions may be mitigated by duty hours restrictions,[18] our data indicate that changes in duty hours alone will not be sufficient. Rather, these challenges reflect a need for training programs to help learners value their self-identified learning goals by sending a clear message that the training programs value them as well. This could be done by dedicating time and resources to the accomplishment of learner-identified learning goals and by better incorporating work toward these goals into daily resident activities. For example, having attending physicians ask residents to identify rotation-specific learning goals, actively help them incorporate the goals into their daily rotation activities, and then monitor progress may initiate more systematic reflection on external feedback and help to develop critical self-reflection. In the case of pediatric residents, this strategy may elevate the value and importance of ILPs in a schedule with multiple and conflicting demands.

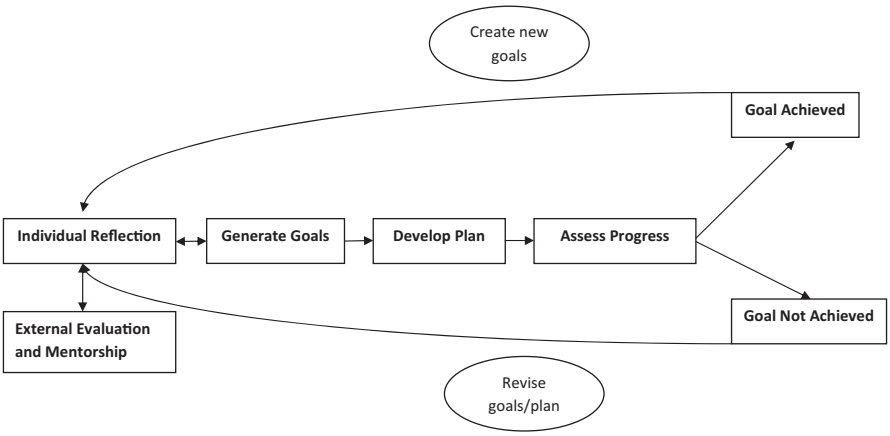

Figure 1 A conceptual model of a lifelong learning process in medical education in which goals and plans are based on **ISMART** strategies (**I**mportant: Choose goals relevant to learner, prioritize achievement of learning goals. **S**pecific: Break broader goals into incremental steps, plan how to accomplish incremental steps. **M**easurable: Set a measurable outcome. **A**ccountable: Use a reminder and tracking system, build in external accountability, establish internal accountability. **R**ealistic: Create achievable goals, seek out and use available opportunities, self-adjust. **T**imeline: Develop timeline for achieving goals, incorporate goals into daily routine.

We identified numerous barriers that make it difficult for residents to develop effective, self-directed learning activities during training. Some of these are inherent to learners and some to the environment of medical education, over which learners have little or no control. Most strategies to overcome these barriers focus on developing manageable, focused goals that are important to learners and on establishing some type of tracking system that creates either internal or external accountability. There is broad consensus that a critical component of being a physician is to practice effective, self-directed, lifelong learning. Therefore, if we are to cultivate these activities in trainees, training programs must develop systems that assist learners in self-assessment, creation of appropriate learning goals and plans to achieve them, and understanding the value in such activity. Future studies should examine the relevance of our proposed model for lifelong learning in other areas of medicine and at different levels of medical education and explore the impact of learner- and program-level strategies to overcome barriers.

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