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Implementation Quality: Implications for Intervention and Translational Science

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Abstract

Purpose: Implementation quality (IQ), a critical concept for translational science, measures the discrepancy between an intervention's intended design and its implementation. Quantifying the impact of IQ on intervention outcomes informs efforts to improve intervention translatability. The purpose of this article is to define and describe IQ and its dimensions (content adherence, quality of delivery, and engagement) with a focus on individualized interventions being delivered in research and practice settings.

Approach: We apply IQ concepts from intervention science in two contexts: (a) an intervention currently being investigated in an efficacy trial, and (b) a practice situation involving the application of evidence-based practice guidelines during clinic visits. IQ measurement approaches are presented using a study protocol, progress notes, interdisciplinary meeting notes, or clinical guidelines, depending upon whether the intervention is delivered during a research study or a clinical encounter.

Conclusions: The investigators describe the necessary infrastructure and support for capturing IQ data and the subsequent complexities and challenges of collecting, measuring, and analyzing these data. Understanding IQ is critical to advancing translational science. Such understanding informs application of appropriate IQ measures, and promotes effective translation of evidence-based interventions into practice. Policy changes are needed to promote IQ assessment to ensure high-quality clinical encounters during which interventions are effectively delivered.

Clinical Relevance: In both research and practice settings, the conceptualization and measurement of IQ will improve patient outcomes by advancing translational science and integrating evidence-based interventions into nursing practice.

Keywords

Implementation quality; individualized interventions; translational science

Nurses are trained to implement evidence-based practice, employing interventions that they individualize to a patients' characteristics, such as their needs, abilities, cultures, and ages (Albrecht et al., 2014; Paternotte, van Dulmen, van der Lee, Scherpier, & Scheele, 2015). Individualizing interventions should increase patient engagement, a factor known to be important in well implemented interventions (Pettigrew et al., 2015). However, individualized interventions may fail if either (a) the core intervention properties were lost in the individualization of the implementation process or (b) the individualization process itself was not optimal. Thus, more specified models for measuring implementation quality (IQ) for individualized nursing interventions is needed. The current article addresses this challenge and advances the effective translation of evidence-based interventions into practice using a model for how IQ can be measured in both research and practice settings.

Defining IQ and Fidelity

IQ can be understood as the degree of discrepancy between an intervention's design and its implementation. Discrepancies can arise when people delivering an intervention (i.e., interveners) make adaptations (i.e., changes) beyond tailoring according to individual differences that may improve or worsen intervention effects, or they deliver the intervention poorly. Well-designed intervention programs delivered poorly cannot achieve their intended effects (Pettigrew & Gal, 2018). While some research treats fidelity (i.e., adherence) as the only important factor in delivery (Horner, Rew, & Torres, 2006; Naleppa & Cagle, 2010), some nursing literature has identified the importance of implementation fidelity, which is defined as adherence and competence (Breitenstein et al., 2010; Stein, Sargent, & Rafaels, 2007). However, the field of intervention science has proposed that IQ subsumes fidelity and implementation fidelity, while including intervention recipient responsiveness or engagement as another factor impacting program outcomes (Berkel, Mauricio, Schoenfelder, & Sandler, 2011). Specifically, existing research and reviews attest to the fact that how a program is transmitted to its target recipient, as well as the recipient's responsiveness to the intervention, predict program efficacy (Berkel et al., 2011; Durlak & DuPre, 2008). We conceptualize IQ along three main dimensions: content adherence, quality of intervention delivery, and engagement (Pettigrew et al., 2015). Content adherence (i.e., fidelity), measures the degree of the prescribed intervention content being covered. Quality of intervention delivery refers to an assessment of overall excellence in intervention delivery, including teaching technique. Engagement refers to recipients' involvement or responsiveness to the intervention and has been linked to positive health outcomes in both research (Miller-Day & Hecht, 2013) and practice (Simmons, Wolever, Bechard, & Snyderman, 2014). Indeed, reviews demonstrate that IQ matters for program outcomes (Durlak & DuPre, 2008), but the question that remains unanswered is how can we measure IQ for individualized interventions in nursing research and practice?

Applying IQ to Individualized Interventions

Individualized interventions (also called individually tailored interventions) are defined as interventions tailored according to individuals' unique characteristics and backgrounds (Wu & Fin, 2015). Individualized interventions are critical to achieving optimum intervention outcomes by allowing interveners to tailor the content according to recipients' unique backgrounds regarding health conditions and demographic characteristics (Lauver et al., 2002). Individualized interventions are protocol driven but remain flexible; they do not incorporate unnecessary material or omit critical intervention components (Dusenbury, Brannigan, Falco, & Hansen, 2003), but, instead, those components must still be reflected in the tailored content.

The challenge of individualized interventions from an IQ perspective is identifying when tailoring deviates from the core components of an intervention, jeopardizing its efficacy. Unfortunately, this issue has received little attention in the nursing literature. This gap in nursing science is a barrier to successful translational science and evidence-based practice efforts. Effective evidence-based interventions may cause little to no change in intended outcomes if poorly implemented, potentially undermining useful programs and misdirecting translational science efforts or conclusions. The purpose of this article is to address this gap in nursing literature. To do so, we apply IQ concepts from intervention science to two contexts: (a) an intervention currently being investigated in an efficacy trial and (b) a practice situation involving application of evidence-based practice guidelines during clinic visits. For each, we focus on how to measure IQ and the associated implications for translational science.

Research and Practice Case Studies

In this section, the authors present a research and a practice case study. The research example illustrates IQ measurement occurring as part of an efficacy trial. The practice example highlights aspects of IQ measurement already included in data collected routinely during a patient care encounter and what aspects are not. Before discussing each of the examples below, it is important to discuss the contextual differences in the ability to capture data inherently present in practice and research settings. Clinic visits prioritize efficiency in assessment, diagnosis, and treatment. Time, funding, and privacy concerns constrain what data can be and is collected. For example, delivery of the intervention is usually video recorded in research settings, but such video recording is rare in practice settings. Thus, IQ in clinical encounters cannot typically be subjected to the same level of scrutiny possible in research studies.

Despite these contextual differences, both types of intervention encounters can be individualized (i.e., tailored according to particular study participant or patient characteristics) and share the challenge of delivering specific content in a limited time period. Hence, research and practice encounter comparisons are useful for illustrating how to address IQ issues as the nursing profession strives to shorten the bench to bedside-clinic-community translation gap.

Research Example: *DRAMA-RAMA*, an Individualized Skill Building Experience

Description

Mighty Girls is an early adolescent intervention for middle school Latinas (Norris, Hughes, Hecht, Peragallo, & Nickerson, 2013). This evidence-based program builds peer resistance skills that help youth avoid engaging in risky sexual behaviors. Findings from the feasibility trial argue for its efficacy in building peer resistance skills and reducing risky behavior (Norris et al., 2013).

Mighty Girls consists of a six-session classroom component and an individualized skill building computer game called *DRAMA-RAMA* (Norris et al., 2013). *DRAMA-RAMA* is a computer simulation game operated by trained interveners with a background in interactive performance and improvisation who guide participants through scenarios depicting various levels of peer pressure (Norris et al., 2013). One assigned intervener tailors game play according to each player's verbal, nonverbal, and affective responses while voicing words for different game characters and manipulating game characters' nonverbal responses much like puppeteers of old.

The IQ measures described below for each IQ dimension are specific to the individualized *DRAMA-RAMA* game that comprises part of the *Mighty Girls* intervention program. These IQ measures rely on both audio-video recorded game sessions and self-report survey data (Table 1). Additional measures of IQ used for the *Mighty Girls* classroom sessions are available from the first author (A.B.N.), but are not discussed here because the tailoring of these sessions was not done on an individual basis as typically occurs in patient care encounters.

Dimensions of IQ

We next define each dimension and provide an example of how it is operationalized with respect to *DRAMA-RAMA* IQ measurement. To be maximally effective, an intervention needs all of these dimensions fully present.

Content adherence

Content adherence is the extent to which the prescribed intervention information is provided during the intervention session (Pettigrew et al., 2015). Measuring content adherence helps the researcher or the clinician determine if core intervention properties were lost in the individuation process. Content adherence is measured for *DRAMA-RAMA* with an adherence checklist that is specific to each *DRAMA-RAMA* game story. The checklist tracks key information that interveners need to provide during each game play in order to effectively create a peer resistance skill training session. Trained coders review the audio-video file and complete the checklist. Checklist data are then summed and divided by the total number of points to be checked, creating a percentage adherence score.

Quality of intervention delivery

Quality of intervention delivery is the quality with which key intervention-specific information is delivered (Pettigrew et al., 2015). In the case of *DRAMA-RAMA*, quality is dependent upon three factors: (a) developmental and cultural appropriateness of each character's response to the player (individuals receiving the intervention are all 7th grade Latinas); (b) the proper amount of peer pressure (given the player's response and demonstrated ability); and (c) the quality of the improvisation (i.e., each character should be portrayed in a consistently distinctive fashion over the various game scenes and in a manner that is true to the character's personality). Quality of intervention delivery is measured using the coding scheme specifically developed for *DRAMA-RAMA* game stories. The coding scheme allows trained coders to rate the quality of intervention delivery during both specific peer pressure scenes and overall game sessions. The trained coders review the audio-video recordings of game plays and code the interveners' quality of intervention delivery. Quality of intervention delivery ratings are then summed to create the total score for each game play.

Engagement

Engagement of the participant is measured in two ways in *DRAMA-RAMA*: first, by using the intervention participants' self-reported rating of the intervention experience (e.g., perceived realism, predictability, and flow of the game; Norris, Weger, Bullinger, & Bowers, 2014); and second, by using Guerrero's (2005) rating scheme to assess intervention participants' nonverbal indicators of involvement during social encounters with the game avatars (vocal and facial expressiveness, body movements, and interaction management) as demonstrated in the video recordings.

Use of IQ data

Content adherence, quality of intervention delivery, and engagement are analyzed as mediators of intervention effects on intervention outcomes as part of the efficacy trial data analysis. This allows the researcher to identify how issues with IQ impact achievement of study outcomes. Much like the challenges encountered in translating interventions from the bench to the bedside-clinic-community, an efficacy trial is challenged by the need to involve a larger team of interveners and a broader set of delivery situations than were used in the less complex and potentially more tightly controlled feasibility trial (Bowen et al., 2009). Fortunately, insights into weak areas of IQ inform training for future interveners. Further, just as in practice settings, time may be limited, unanticipated barriers to intervention delivery may occur, or interveners may not deliver all aspects of the intervention. IQ data allow the researcher to investigate, and to even develop a statistical model for, the levels of IQ needed to deliver a sufficiently substantive intervention effect. The statistical tests needed to quantify intervention effect depend on the target populations and the research focus. For example, a Pearson correlations coefficient can provide a cross-sectional analysis while a Kaplan-Meier calculation can examine the intervention effect over time. Thus, IQ data participating organizations evaluate the practicality (in terms of effectiveness, time, and cost) of translating the intervention to their own settings.

Practice Example: Clinical Visits Using Bright Futures Clinical Guidelines, and Individualized Health Promotion Encounter

Description

Given that *DRAMA-RAMA* intervenes with early adolescents, the authors will use the Bright Futures guidelines relating to the clinical care of early adolescents to illustrate application of IQ dimensions. Bright Futures is an individualized health promotion encounter delivered by nurse practitioners (NPs), physician assistants, and physicians that includes specific clinical guidelines for children from birth to adolescence. In this article, we examine individualized encounters delivered by NPs because we are focused on intervention delivery within the field of nursing. Bright Futures has contributed to increasing standardized screening rates (Radecki, Sand-Foud, O'Connor, Sharp, and Olson, 2011), has been recommended for its systematic approach to improve pediatric patient care (Shaw, 2008), and has been found feasible in improving preventive and developmental care for young children (Lannon et al., 2008).

Developed by the American Academy of Pediatrics (AAP), the Bright Futures clinical guidelines take a holistic, team-effort approach to providing developmentally appropriate well-child and adolescent care (Bright Futures, 2016). The clinical guidelines contain an age-specific child visit checklist, brief questionnaires for child and parent, discussion points for parents, and a comprehensive assessment guide for clinicians. These guidelines create a guided health promotion encounter that is tailored by individual factors such as patients' age, developmental level, health concerns, and assessment findings.

Dimensions of IQ

We define each IQ dimension and provide an example of how it is operationalized by Bright Futures.

Content adherence

Content adherence (i.e., tracking of core intervention properties) can be measured using the Bright Futures clinical guidelines that are designed to be used by NPs during the patient care encounter, which form a checklist that the NP can complete during care delivery. The checklist drives assessment of patients and directs age-appropriate education during a well-child visit. It can also be integrated into the electronic medical record and used to calculate a content adherence score that can be linked to future patient care outcomes. To date, the checklists are either reviewed for billing purposes or by supervising or collaborating physicians, as dictated by the State Nurse Practice Act/Regulation.

Quality of intervention delivery

Quality of intervention delivery is difficult to measure in a practice setting because doing so requires direct observation or audio-video recording of the provider-patient interaction. Hence, the quality of care delivered by clinicians is not routinely measured, let alone analyzed. One alternative option to capture quality of intervention delivery would be to consider proxies or predictors of high-quality delivery such as clinical competence

(assessing, diagnosing, and providing appropriate treatment) and communication competence (effectively communicating medical information and educating early adolescents, considering relationship dynamics between patients and their parents to achieve intended health outcomes).

Engagement

Engagement of the patient can be captured in part with patient experience and satisfaction survey data that are routinely measured based on the demands of accrediting bodies (e.g., The Joint Commission) and reimbursement mechanisms. Questions might assess if patients would recommend the provider or service to a friend. It is not yet possible to augment this self-report with data regarding verbal and nonverbal behavioral indicators of engagement displayed during a patient care encounter because, as with quality of delivery, audio-video recording of these encounters is not possible. However, technological advances in artificial intelligence may enable this to be done in the near future without violating the Health Insurance Portability and Accountability Act (HIPPA; Berkel, Smith, Gallo, & Atkins, 2016).

Use of IQ data

Healthcare facilities do not routinely analyze data representing content adherence, patient experiences, or patient satisfaction in an attempt to link these phenomena to patient outcomes. However, these data could be used in three ways, all of which could improve institutional effectiveness. First, these data could be used to understand how IQ impacts achievement of clinical outcomes, potentially identifying skills gaps and training needs. Second, these data could be used to model how changes in clinician expertise could result in better outcomes for particular interventions, thereby creating a business case for additional training or hiring of particular types of clinicians based on patient population needs or leadership decisions to implement new practices at the unit, department, or institution level. Third, these data could help identify why interventions shown to produce downstream cost savings to the organization under controlled conditions fail to replicate these cost savings at a particular institution. Failure could be due to poor IQ rather than the intervention's inherent lack of efficacy. Knowing the difference would allow institutions to determine if additional training or personnel is needed and justifiable, and would simultaneously advance translational science.

Discussion

The purpose of this article is to advance translational science and, ultimately, to improve patient outcomes by describing the conceptualization and measurement of IQ in both research and practice settings. Three key dimensions of IQ (adherence, quality of delivery, and engagement) used in our research study are described and compared in terms of how they can be captured in a practice setting. These three dimensions are listed in Figure 1, with lighter shading indicating dimensions that are not measured in our practice setting example. Only content adherence and one element of engagement (i.e., patient satisfaction) are routinely collected during clinic visit encounters when NPs use Bright Futures clinical guidelines in clinical practice. We suspect this practice example is fairly representative of

clinical practice during a patient care encounter in which a guideline-driven, evidence-based intervention protocol is being translated to practice. Because research attests that IQ is consequential for intervention efficacy (Durlak & DuPre, 2008), important challenges remain for IQ assessment in practice settings. Surmounting challenges must overcome barriers of privacy and confidentiality, not to mention time pressure. These challenges are discussed next along with the implications for practice settings and translational science efforts related to implementation of evidence-based interventions, policy, and nursing education.

Implications for Practice Settings and Translational Science Efforts

Opportunities exist in practice settings for measuring IQ and using resulting data to drive and evaluate practice, but three challenges exist: (a) making collection of content adherence data routine; (b) developing new patient self-report measures to better capture quality of intervention delivery and engagement; and (c) creating a data analytic system that routinely integrates IQ data with specific patient care encounters, and creates opportunity to weigh IQ *vis-à-vis* individual patient care quality factors and cost (e.g., illness severity, comorbidities, and age).

Making collection of content adherence data routine

Content adherence is a dimension of IQ that can be most easily captured in clinical practice in the form of checklists. However, checklists may not be consistently available for clinicians to complete or may not be consistently completed. Thus, a first step for practice settings is to assess the extent to which checklists are used to drive implementation of interventions, and the completion rate for those that are available. Once this assessment is completed, the next step is to motivate clinicians to complete existing checklists or engage them in designing new or better adherence assessments that are considered useful and not unduly burdensome. Finally, policies and procedures should be established within the organization to require the use of an adherence assessment created or modified as necessary by the clinicians in order to ensure feasibility.

Developing new patient self-report measures

New measures are needed to capture patient self-reports of quality of intervention delivery and engagement. At least some of these measures should be specific to the intervention or activity experienced during the patient care encounter. Additionally, these measures should be developed as part of the translational science associated with integrating new evidence-based interventions and care activities into practice.

The challenges for new IQ measures are similar to those present for global measures of satisfaction commonly used in patient care settings (Crow et al., 2002; Williams, 1994). These new measures need to capture only the quality of intervention or activity delivery and engagement of the patient in the experience, not other characteristics such as a patient's general feelings towards the clinician or the gap between patient expectations and the recognized standard of care. Thus, advances in the development of IQ measures may also advance the science of assessing global patient satisfaction.

Developing new self-report measures of quality requires clinician–researcher partnerships to identify quality elements that patients can self-report, and elements that can be inferred from patient content comprehension. Even though clinicians may communicate correct content, that content is meaningless unless communicated in a way that patients understand. However, quality of delivery in an individualized setting is precisely about tailoring delivery of the content according to various characteristics known to influence comprehension, such as patients’ culture, cultural differences between healthcare providers and patients, health conditions, and health literacy (Albrecht et al., 2014; Koh, Brach, Harris, & Parchman, 2013; Paternotte et al., 2015; Samuels-Kalow, Stack, & Porter, 2012). Thus, the ability to compare content adherence and content comprehension data for the same type of encounter allows administrators to identify clinicians who succeed in delivering the correct content but need training in how to tailor content delivery for particular types of patients.

Developing a new self-report measure of engagement requires going beyond a patient’s willingness to recommend that friends see the same clinician for a particular patient care encounter and could include items derived from clinical research literature that link engagement to specific clinician communication skills and behaviors. For example, the systematic review by Pinto et al. (2012) found that engagement during clinical encounters depends on clinicians’ ability to listen to patients, ask patients questions, and show sensitivity to patients’ emotional concerns. Henry, Fuhrel-Forbis, Rogers, and Eggly’s systematic review (2012) found that clinicians’ nonverbal cues of warmth and attitude of listening were linked to patient satisfaction.

Bitzer et al. (2012) created and validated a measure of patient satisfaction for pediatric outpatient settings, the Child ZAP, which could serve as a model for developing measures specific to other pediatric settings and possibly other patient populations. The Child ZAP includes items such as parents’ satisfaction with their child’s care as well as parents’ perceived levels of clinicians’ support, empathy, and patience. However, additional measures are needed for other settings, and it is not clear whether the Child ZAP could be improved with the inclusion of additional communication skill specific items.

Alternatively, a generic measure (i.e., useable across patient care settings) might be created by using items targeting particular communication skills and behaviors. A disadvantage of generic measures as well as measures like the Child ZAP is that these measures rely on patient self-report and are subject to self-report biases (e.g., not wanting to make the clinician look bad). Nevertheless, as we discuss in the later section on Implications for Education, simulation may provide additional data to triangulate with these self-report data, thus surmounting the traditional limitations of self-report.

Creating a data analytic system

While creating IQ measures and integrating them into clinical practice is critical, it is only a first step. Equally critical are (a) creating a system that integrates IQ data present in the medical record with patient self-report data being collected as part of quality of care metrics; and (b) designing an ongoing analytical process for these IQ data that allows the data to be linked to future patient outcome data being captured in an ongoing medical record that integrates care across patient care settings. As such, the most effective use of IQ data will

occur in healthcare systems that include acute, home, and primary care services, so that the impact of interventions delivered in one setting can be tracked across care needs that are met in other care settings. Hence, health maintenance organizations (HMOs) may choose to begin this effort by identifying high-cost episodes of care, such as cancer treatment-related symptoms in elderly patients that, if not well managed, result in unplanned readmissions, or poorly managed asthma that results in emergency room visits. Similarly, insurers may seek to incentivize institutions conducting these types of analyses. Rather than wait for HMO administrators or insurers to initiate these efforts, doctor of nursing practice (DNP)-prepared nurses can choose to lead the effort by identifying the data sources and working with administrators to put a data analytic system in place to improve both quality and cost-effectiveness of care.

Implications for Education

Familiarizing nurses with IQ, its measurement, and how evaluating IQ can improve effectiveness of patient care encounters can be integrated into nursing education at all levels. Starting with both entry level (associates and baccalaureate degree) and continuing through advanced practice level (masters and DNP degree) nursing education, students should learn about the impact of IQ on patient outcomes, the dimensions of IQ, and examples of IQ measures. Clinical education simulation scenarios in both entry and advanced practice level education can incorporate content adherence checklists, and debriefing of these simulations can include the application of IQ dimensions, according to the appropriate scope of practice for each level. For example, review of audio-video recorded performances can include an assessment of the quality of delivery, and when actors are involved in place of mannequins, engagement can also be assessed.

At the doctorate level, nursing PhD and DNP students can work together using an iterative design process (Nielsen, 1993) to create feasible IQ measures that are easy to implement. The iterative design process would be fueled by the expertise each student brings with respect to measurement development and content matter expertise. For example, PhD students could create an initial measure “prototype” after gaining knowledge of the specific intervention for which IQ measures are needed from the DNP students. DNP students would then review the prototype and give feedback, resulting in the PhD students refining the prototype or determining if a communication or human factors scientist (or PhD student) is needed as a consultant to provide more expertise. As the measure becomes more refined, the DNP students would then try the measure out in simulation while the PhD students (and any consultants) watch. The two groups of students (and any consultants) would then debrief, discussing the fit of the measure to the phenomenon being measured and the constraints of clinical practice. Thus, working together, PhD and DNP students could collaborate to create measurement approaches that are applicable and meaningful to practice settings while gaining experience leading an interdisciplinary team when expertise from outside the discipline is needed.

Further Considerations for IQ Measurement and Opportunities for Future Research

Developing measures of IQ for individualized interventions would help to build the knowledge base for aligning IQ with clinical outcomes, as well as elucidate the relative importance of various IQ dimensions to particular clinical outcomes. However, this work requires accounting for the diverse nature of individualized clinical counters. For example, IQ for explaining informed consent requires delivery of accurate and high-quality information tailored to the patient's educational level and familiarity with research. However, high-quality delivery of an intervention designed to produce an advance directive requires that the delivery be skillfully tailored according to the emotions expressed by patients and family members. Hence, the characteristics emphasized in the tailoring process may vary with the intervention goals. Additional key research questions related to benchmarking levels of IQ necessary for quality of care or obtaining desired outcomes remain. Resolving these questions will help advance nursing science, as well as intervention and translational science, and ultimately patient outcomes.

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Clinical Resource

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Figure 1.

Comparison of implementation quality (IQ) dimensions between individualized skill building experience and individualized health promotion encounter using the integral theoretical model of IQ and intervention outcomes. Gradation of color represents degree to which each IQ dimension is measured.

Table 1.

Comparison of Implementation Quality Dimensions Between an Individualized Skill-Building Experience *DRAMA-RAMA* and Individualized Health Promotion Encounter That Uses the Bright Futures Clinical Guidelines

	Individualized skill-building experience <i>DRAMA-RAMA</i>	Individualized health promotion encounter
Notes on recording the encounters	Intervention encounters are video-recorded	Clinical encounters are not video-recorded
Content adherence	Adherence checklists (video data)	Clinical guidelines checklist
Quality of intervention delivery	Quality of intervener (video data)	Not measured
Engagement	Involvement (video data)	Not measured
	Self-reported rating of intervention experience (broader than satisfaction)	Limited to patient satisfaction
Outcome measures	Implementation quality measures analyzed in relation to the study outcomes as mediators of intervention effects	Completion of practice guidelines/patient satisfaction and patient outcome typically not linked