

# Current Developments in Delivering Customized Care: A Scoping Review

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## Research article

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# Abstract

**Background** In recent years, there has been a growing interest in healthcare personalization and customization (e.g. personalized medicine and patient-centered care). While some positive impacts of these approaches have been reported, there has been a dearth of research on how these approaches are implemented and combined for healthcare delivery systems.

**Objective** The present study undertakes a scoping review of current developments for delivering customized care, according to theoretical and practical guidelines for customization delivery approaches.

**Methods** Article searches were initially conducted in November 2018, and updated in January 2019 and March 2019, according to Prisma guidelines. Two investigators independently searched MEDLINE, PubMed, PsycINFO, Web of Science, Science Direct and JSTOR, The search was focused on articles that included “care customization”, “personalized service and healthcare”, individualized care” and “targeting population” in the title or abstract. Inclusion and exclusion criteria were defined. Disagreements on study selection and data extraction were resolved by consensus and discussion between two reviewers.

**Results** We identified 70 articles published between 2008 and 2019. Most of the articles (n = 43) were published from 2016 to 2019. Four categories of patient characteristics used for segmentation analysis emerged: clinical, psychosocial, service and costs. We observed they often coexisted with the most commonly described combinations, namely clinical, psychosocial and service. A minority of articles (n = 18) reported assessments on quality of care, experiences and costs. Finally, few articles (n= 6) formally defined a conceptual basis related to mass customization, whereas only half of articles used existing theories to guide their analysis or interpretation.

**Conclusions** There is no common theory based strategy for providing customized care. In response, we have highlighted three areas for researchers and managers to advance the customized development concept in healthcare delivery systems: better define the content of the segmentation analysis and the intervention steps, demonstrate its added value, in particular its economic viability, and align the logics of action that underpin current efforts of customization. It would allow them to use customization to reduce costs and improve quality of care.

## Background

Increasingly, we encounter “customization”, “individualization”, and “personalization” terms in healthcare settings. Every patient wants to feel they are receiving optimized care, tailored to their particular needs, thus the traditional notion of a “doctor-patient relationship” implies customization is at the core of caregiving for health professionals (1). Recently, customization has been combined with “personalized medicine”, which has evolved to “precision medicine” (2). This takes the form of developed targeted therapies based on a patient's genetic characteristics (3). There is also a logical link between Patient-Centered Care (PCC) and care customization, where the care process considers individual patient preferences, needs and values (4–5), often introducing personalization as a given component of the PCC

package (6). These notions have also been applied to individualized care plans, often managed by nurses (7), or to target care to the most vulnerable populations, or specific minorities, requiring a mix of clinical and social needs (8). It is evident that many applications currently in practice or being proposed, fit under the “care customization” rubric. These approaches converge on a care and service delivery model that could implement effective customized approaches into practices and organizations. These models, that are by definition, more flexible and demand-driven, could lead to better patient outcomes and experiences, and even if problematic, could reduce or avoid extra-costs (9).

However, it is unclear what kind of information is available in literature on how these developments are effectively delivered, and converge to define a customized care delivery model. For example, how are specific patient characteristics selected and taken into account in routine care? How are services and care established, assembled and combined for a specific patient? How do we assess the appropriateness of patient classification and care components as care is delivered? The answer to these questions can help to understand the benefits of care customization in practices and organizations.

For these reasons, a scoping review was conducted in order to systematically map the developments done in this area, as well as to identify any existing gaps in knowledge. To do this, it was necessary to have an analytical framework to assess current care customization service delivery. The “Mass Customization” (MC) framework is a benchmark in this area, illustrating a demand-driven model of production as opposed to a supply driven model (10). The concept emphasizes the need to respond to the needs and preferences of the consumer or user, providing goods and services at or near mass production prices. Four elements must converge to generate an effective customized delivery (11–13): (i) Design-based on a segmentation analysis of the user, often referred to as “customer relationship management”, where the goal is to precisely match demand to the service or product (14–15); (ii) Fabrication, where the system (factory, service unit or team) adapts production to meet each of those needs; (iii) Assembly, where sub-systems or “modular” service structures flexibly combine multiple standardized products and services (11, 16); and (iv) Distribution, where coordination and integration of different products and services facilitate timely delivery to the customer (17–18). “Personalization” is also used in this context, and describes the employees’ attitudes, so a customer’s preference is catered for (19). These four stages of MC define two phases of any customization delivery approach: (i) segmentation analysis of individual user characteristics, and (ii) customized intervention (i.e. fabrication, assembly and distribution), and modularity related issues (20).

Several studies have applied MC in the healthcare field. In their early and seminal paper on customization, Lampel and Minzberg (21) provided multiple examples related to care, stressing how much the patient’s clinical condition already lent itself to personalization (e.g. cataract surgery in a healthy person is much less customizable than a complex cardiac surgery, thus it proceeds differently). Recently, Mannion and Exworthy (22) reactivated a debate on the antagonism between standardization and customization, making service delivery homogeneous, but anonymous and customizable (23), thereby requiring different combinations of customization/standardization in care activities. Minvielle *et al.* (24) underscored the conditions for implementing a MC model along the care pathway. Several studies

also proposed care services in a modular format, using a menu of options adapted to individual patients or unit needs, in different care contexts (25–29).

All these approaches converge to demonstrate how to implement MC in healthcare.

In contrast, there is a limited body of literature using MC as a theoretical framework for evaluating current innovations in healthcare delivery. In using this approach, the transfer of MC to the health sector must be considered carefully, because it comes up against several limitations. The objectives pursued in commercial and public health sectors are quite different. Similarly, consumer and patient needs differ accordingly. These limitations therefore express reservations to using MC as a benchmark theory in health care. It serves only as a lens during our scoping review to analyze current efforts which do not necessarily refer to a managerial approach to the delivery of care.

Thus, we adopted a minimalist approach to assessing a MC based framework in our scoping review. The following research question was formulated: What is known from the literature about recent developments which addressed the two components, segmentation and customized intervention, of any customized delivery approach? In adopting this strategy, we selected and analyze studies that used a segmentation analysis to develop, disseminate, implement, and/or sustain customized health interventions. We were specifically interested in documenting which patient characteristics these approaches were used for, which participants were involved, for what goals they were designed for, and what kind of customized interventions were conducted. Since the concept of a personalized care delivery model is not well established, we also explored if a conceptual basis, MC or other conceptual/theoretical structures, was present.

## Methods

This review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for scoping reviews (30).

Article searches were initially conducted in November 2018, and updated in January 2019 and March 2019. The following electronic databases were reviewed: MEDLINE, Scopus, JSTOR, Web of Science, Pubmed, Psycinfo and Science Direct. Searches were limited to English-language articles, published over 12 years (January 2008–March 2019). This period was selected as it reflected recent/current efforts in delivering customized care. The search was focused on articles that included “care customization”, “personalized service and healthcare”, individualized care” and “targeting population” in the title or abstract. Following the principle of “narrowing” the topic (31), we instigated a second Boolean search strategy on Web of Science using the following keywords: (1) care customization OR personalized medicine OR personalized service OR targeting populations OR individualized care AND (2) segmentation analysis OR profiling patients OR categorizing patients AND (3) patient needs OR patient characteristics OR patient preferences OR population characteristics OR patient demands (see appendix 1 for an example of an entire search strategy). Last, the search was supplemented by the manual review of

eligible bibliographies for inclusion (six articles were added). The final search results were exported into Mendeley, and duplicates were removed by a reviewer (AF) at each iteration.

In total, 6390 articles were identified. Inclusion and exclusion criteria were defined according to our scope objectives. As customization in health care is not definitively defined, we included any studies addressing aspects of segmentation analysis and customized intervention, in real healthcare delivery contexts. We defined “segmentation analysis” as any analysis of patient characteristics, even without explicit reference to specific customization methods, but with the objective of customizing delivered care and services. We also defined “customized interventions” as any developments in health supply that implemented targeted answers, no matter how the care team/process was designed, assembled or delivered, and regardless of the type of practice or organization, e.g. individual, small or large group. Lastly, we did not predefine how segmentation analysis and interventions interacted, and we accepted critical analyses and reviews of care customization strategies when they addressed both key parts of segmentation analysis and customized intervention, as we defined it. We tested our selection criteria on 20 articles (randomly extracted from the first literature review) to determine criteria modification. Accordingly, a second inclusion and exclusion criteria list was defined to refine our final selection:

#### **Inclusion criteria;**

- (1) Full-text in English.
- (2) The notion of customization and/or targeting and/or individualized and/or personalization in association with healthcare.
- (3) Patient needs, demands or preferences were addressed to create a customized strategy, related to a segmentation analysis in a health care delivery context.
- (4) The development or design implementation, sustainability, and/or dissemination of a customized intervention using a segmentation analysis. Articles were included if they explicitly reported a customization approach (i.e., population mapping, assessment of tailored interventions and properties, or analysis of a MC approach).

#### **Exclusion criteria:**

- (1) Care customization was mentioned, but segmentation analysis and/or customized interventions were not reported (e.g. the primary focus was human or technological support, or other related topics on care customization, without documenting a segmentation analysis and customized intervention; the customization approach was only expressed as a recommendation or a requirement).
- (2) Segmentation analysis was not followed by a customized intervention in the care delivery system (e.g. genomic studies that suggested new targeted therapies, or questionnaires assessing patient quality of life; segmentation analyses from a technical or methodological viewpoint (e.g. selection bias, regression analyses), or analysis of patient needs, without reporting a customized intervention).

(3) Segmentation analysis and/or customized intervention as a strategy for a clinical trial, fundamental research purposes or reviews, articles not based in the real world of care delivery (i.e. randomized trials assessing a real-world intervention were included).

(4) Articles investigating a customized intervention without referring to a segmentation analysis.

(5) Any stratification method or regression analysis unrelated to a customized intervention (e.g. analyzing relationships between a set of factors (e.g. patient behaviors), and an outcome; or customized clinical scores predicting outcomes, without an explicit customized strategy of care).

(6) The customization approach is applied outside healthcare, or to any healthcare delivery aspect, but not to patient characteristics (e.g. electronic health records or monitoring tools).

(7) Articles comprising comments, commentaries, dissertations or conference proceedings.

To increase consistency among reviewers, two investigators screened the same 200 first abstracts (AF, EM). Titles and abstracts were then independently reviewed by one investigator (EM). Abstract analyses generated 240 full-text articles which were independently assessed for review eligibility by the two same reviewers. Consensus was agreed for uncertain cases through discussion between the two reviewers, and in three cases with a third reviewer (MW). Finally, we did not analyze methodological qualities in our studies, which were heterogeneous. However, our goal was not to uncover evidence on specific customized delivery models, but to qualitatively extract information from the literature on a not well-defined topic. All the steps of the literature search, numbers of citations screened, duplicates removed and full-text documents assessed, are reported using a PRISMA flow diagram (Fig. 1).

## Results

The final selection included 70 articles. Our results are presented across three broad categories: 1) context characteristics (publication year; sample country/location; health topic; type of review); 2) customized strategy (applied versus potential/proposed interventions; patient characteristics; type of patient characteristics; intervention; impact evaluation), and 3) use of a conceptual basis/theory (articles that mentioned MC; theories informing a conceptual basis related to care customization) (Table 1). See Table 2 for full results.

## Materials

Health topics varied from clinical conditions to socio-economic patient characteristics (e.g. gender characteristics; marginalizing conditions, immigrants). The most common health topics were cancer (n = 13) and the elderly (n = 9). Additionally, some articles (n = 8) addressed care customization strategies, using cost and resource allocation generated by patients (i.e. “Higher Utilizers” or “High needs High costs”). Lastly, some articles (n = 8) addressed care customization strategies in a general way, applicable to any type of patient (in this case, we use the word “transversal”).

Most articles (n = 42) were published between 2016 and 2019, with few published in the early years (i.e. five between 2008 and 2011, and 23 between 2012 and 2015). Approximately half the articles were based in the United States (n = 29). The remaining articles were outside the US: seven in Asia (China, India, Indonesia, Iran, Japan, Philippines, Taiwan), twenty in Europe (seven in the Netherlands, four in the United Kingdom, and one each in Denmark, Finland, France, Germany, Italy, Switzerland), and five across different countries.

### **Care customization efforts**

Two categories emerged when organizing the articles: those that applied care customization to an existing intervention (n = 28), and those that proposed the application of care customization to improve delivery care systems (n = 48).

We also categorized the articles according to the patient characteristics that support the segmentation analysis. Four categories emerged: (1) clinical needs (including genomic and molecular features); (2) psychosocial needs (i.e. needs due to financial and social status, psychological and personality traits, religious and cultural values; preferences related to behavioral attitudes in relation to health issues); (3) service needs (i.e. demands or preferences about aspects of life, apart from health issues); (4) costs (i.e. costs or resources allocated by the care process). These categories often overlapped, but for the purposes of this review, it was important to understand which patient characteristics were strongly informed by the segmentation analysis. Most articles reported on clinical needs (n = 51), but also psychosocial (n = 39) and service needs (n = 30) were covered. Clinical needs are often related to genomic characteristics, but they also cover new personalized plans, based on risk stratification (e.g. the decision to provide preoperative sedation is stratified by autism spectrum severity levels, before surgical procedures) (32). Psychosocial needs included financial barriers (e.g. for: vision care appointments (33); services related to social status (8, 34); psychological characteristics (e.g. personality traits) (35, 36); emotional attitudes (37); and cultural values (38). The service category emerged from analyses, while answers to patient demands were beyond what healthcare systems could usually deliver. Examples of service needs included home services for older persons, such as home energy assistance, legal services (39) or appointment scheduling (40).

Several types of patient characteristics could be identified during the segmentation analysis phase. Associations between different types of patient characteristics were distributed between as follow: homogeneously between 0, 1 and 2 associations and less for 3 associations (n = 5). The most usual situations were segmentation analyses based on clinical, psychosocial and service needs (n = 19), and clinical and psychosocial needs (n = 11). For example, Van der Laan *et al.* (41), in a study in Dutch older adults, defined five groups of patients based on a set of clinical and psychosocial need assessments. The assessment tool was proposed as a first triage step that offered more contextual information than purely disease-based information. The second most frequent segmentation analysis was based only on clinical needs (n = 12).

Interventions were also categorized according to the three steps of any MC effort described in the theoretical part: (i) fabrication (i.e. any new care or service catering to the needs and demands of patients); (ii) assembly (i.e. any new structural combination of multiple standardized products and services, based on the needs and demands of patients) and (iii) distribution (i.e. any new coordination effort and integration of different products and services allowing timely delivery to patients). Examples of new care and services were various (n = 20): from concierge services offering transportation assistance for medical tourism (42), to new digital and artificial intelligence (AI) technologies that personalized physician choice for patients (43, 44), creating specific facilities depending on gender (45, 46), genomic tests (47-49) and biomedical informatics support (50). Examples of assembly were less frequent (n = 7); one proposal aimed to combine care and services produced by two hospitals and an inpatient team in the same individualized care package, facilitating an inter-organizational infrastructure (51), nursing homes facilities (52), or accountable care organizations (53). In contrast, distribution examples (n = 54) were mainly represented by coordination efforts in various clinical situations (e.g. during transitional care,) (54). Distribution efforts also stressed communication efforts, in particular for personalizing preventive messages according to lifestyle (43, 55-59), or cancer survivorship (60). Several studies also referred to the creation of multidisciplinary teams (61-63), including carers (64) and family members in specific conditions (i.e. to care for older persons with cognitive impairments) (65). Stratification of interventions was also often reported, and was based on need requirements (66), and/or taking new needs and demands into account (i.e. behavioral and psychological characteristics) (67, 68); personality traits (35, 69); lifestyles for obesity prevention (59); and cultural attitudes (60). Organizational aspects like the organizational climate (70), the adaptation of routines (71), patient-nurse assortment (72), integration of new data and information in electronic health records (47, 73), were factors promoting customized interventions. Lastly, these distributional aspects were dependent on preferences and needs that could change over the course of care (74).

## **Impact Evaluation**

Several articles (n = 18) reported added-value evidence from customization. These were relatively equally distributed between patient experience (n = 7), cost (n = 6) and quality of care (n = 5), including quality of life (75). However, none demonstrated customization, incorporating all three criteria.

## **Theories**

We observed that only 10% of articles explicitly applied MC theory for interventions, and more generally that theoretical frameworks of any kind were often missing. Twenty-two different theories (e.g. inter-organizational collaboration or optimization of personalized assortment) informing segmentation and customized intervention were identified in 38 articles. Precision and personalized medicine (n = 5), individualized care (n = 6) and patient-centered care (n = 5) were the most represented theories.

## **Discussion**

In this scoping review, we identified 70 articles addressing how customization approaches are delivered in health care. Our results indicate the absence of a common strategy for delivering customized care based on a conceptual basis. First, while the benefit of a customized delivery model is often advanced in recent years (the majority of papers have been published in the past four years), there is little conceptual basis that supports current efforts (the reference to a conceptual basis is only mentioned in about half of the studies). In this case, studies refer to a variety of models and theories (e.g., individualized care or consumer-centered care; patient-centered care or precision medicine; social marketing theories or models equity-oriented health care and “essential care”) (75) (39). The theory of the “MC” is for its part little cited (24, 26, 76).

Second, the current efforts appear to be carried out in parallel, according to different logics of action. By logic of action, we refer to the definition of Strauss et al. (77) in which specific participants reflect common motivation for acting (i.e. categorizing patient characteristics and customized interventional responses) (77). Depending on the focus given to one patient characteristic, or to the different association between them, four distinct logics of action can be defined: 1. Clinical; 2. Population health; 3. Patient-centered care and 4. Financial. Segmenting patients according to their clinical characteristics is “natural” in health care, and flows from the fact each patient is a single case. This clinical logic has recently been updated with the emergence of personalized and precision medicine, as highlighted by different articles (50, 78). Beside this clinical logic, a second logic orients customization development to the psychosocial needs of the patient. In this instance, customization efforts have generally the goal to reduce inequalities to access and outcomes across populations. A good example of this comes from Ford-Gilboe *et al.* (40), who demonstrated that providing more equity-oriented health care improved health outcomes for people living in marginal conditions. The responsibility for structuring population health customization is most often borne by public health professionals, academics engaged with communities, local decision-makers, and social workers (79, 80). The third logic, patient-centered care, describes how healthcare organizations respond to patient demands and preferences. In this context, care-giving is seen as a “service” on behalf of, and at the direction of patients. This logic is often referred to as “patient-centered care”, but in some cases is viewed through the notion of individualized care or marketing theories (42). When patients are targeted by the costs their processes of care generate, they fall into a fourth financial logic. In this case, customization strategies have a common goal to target higher resource users, and to propose a customized intervention specifically to this subpopulation, applying it in various conditions. This financial logic generally refers to managers of health organizations and health systems who wish to rationalize costs. These four customization logics are not separate or independent, as evidenced by the combinations between clinical, psychosocial and service needs. The most common combinations observed in our review are segmentation analyzes associating clinical, psychosocial and service needs (n = 19), and clinical and psychosocial needs (n = 11). However, each logic reflects a potentially strong force that guides the division of work in health care. As such, they may create a set of “stovepipes” where participant groups develop a specific point of view of their organizational and professional goals, and similarly, the structure of their work follows this view, potentially undermining the promise of a common care customized delivery model. For example, the enthusiasm for personalized and

precision medicine contributes to the spread of individually-focused clinical practices. This may, on its own, lead to quality improvements, and thereby advance the health of an individual population (81). But this type of customization could be viewed by public health leaders as “premature” or inappropriately individualistic, thus missing out on the potential offered by broader applications of customization (82).

Given the nascent and heterogeneous state of the knowledge in this area, this is an important time to reflect on the definition and use of theoretical frameworks for building a theory-based customized care delivery model. We highlight three areas for researchers and managers involved interested in this field to move in this direction.

A first area of research could focus on the content of the segmentation analysis and the customized intervention steps in order to define a better conceptual basis. A first step consists in clarifying and increasing the characteristics of the patients taken into account during the segmentation analysis (65). If we set aside the cost criterion which embodies another logic (i.e. the measurement of efficiency), many criteria are used to cover the needs, demands and preferences of patients. Beyond clarifying the concept of clinical and social needs (41), different articles stress the role of other patient characteristics: patient behaviors (e.g. the impact of negative personality traits in care delivery (35, 69), and preferences or demands expressed on subjects unrelated to health, but related to certain aspects of daily life, when encountering a health issue (e.g. lifestyle changes to prevent childhood obesity) (61). They suggest that the usual characteristics of age, sex, clinical condition and education, may not predict how patients tolerate the adaptation of particular interventions (68), and call for opening up of patient characteristics used during segmentation analysis, and the type of data collected (67, 83). In this consideration of a greater number of patient characteristics, modern profiling methods based on the processing of big data, may also have a role (44). They can help develop forms of segmentation that identify the needs and demands of each patient (84). This trend, if it is confirmed, could influence the conceptual basis of any care customization delivery model. More than a "MC" model (from mass to customization), it is a model of "singularity on a large scale" (from singularity to mass) that acknowledges the uniqueness of each patient by capturing a variety of needs and demands, which would serve as a conceptual basis.

Research could also help structure the content of a customized intervention. Several articles underlined the importance of coordination and communication efforts in customizing interventions, in particular by emphasizing the role of structural integration or developing multidisciplinary teams (61, 62, 63). Other articles have stressed the importance of personalizing professional-patient relationships (85) while some others have stressed the key-role of modular packages (26). The variety of actions listed during customization interventions calls for a more precise content, and how to apply them to the different stages of the patient pathway, within hospitals, but also during transitional care and primary care.

A second area of research relates to the added-value of a care customization delivery model. Our review reveals some positive impacts of care customization on quality, patient experience and costs. However, if we assume that more customization brings better outcomes and more satisfying experiences, the impact on costs requires more investigations. Investments for increased customization may bring additional

costs at the different steps: investment in new methods of segmentation analysis (even if analytical algorithms can facilitate it) (86); new services (e.g. new therapies, “concierge” systems, home services) (87); or new forms of coordination between different healthcare professionals, managers, and social workers. Equally, several studies reported savings generated by customization, by reducing unnecessary hospitalization (54, 62), treatment costs (73), and duplication (88). Other studies (8, 51) highlighted that an earlier and more focused identification of “complex” patients and/or high user can help health care organizations design more appropriate and efficient organizational responses. Chaudhuri and Lillrank (76) also argued that a customized strategy applied to high volumes of similar patients, and could be economic by implementing common standards of care. However, these data are sparse, and require more research of any care customization interventions to give evidence of their added-value, and in particular, of their economic viability (89).

A third last area of research could explore how to align the logics of action that underlie the efforts of care customization. While a single approach to customization of care is probably unrealistic, the compartmentalization of different logics may limit the impact of current customization efforts, resulting in additional costs. Researchers can help unravel the logics of action that support such developments, and find ways to facilitate their alignment, as in the case of customizing “high-need, high-cost patients” (8).

There are several limitations to this scoping exercise. Firstly, customization of care is rapidly growing and changing. There may be recent or more current efforts in developing interventions that have not yet appeared in the literature, or during our search, and as such, we may have inadvertently missed recently published articles. We excluded articles that addressed care customization, but not in routine healthcare delivery contexts (i.e. in clinical trials where they are not applied in real life contexts, fundamental research, or innovations at early development stages). As such, it is likely we underestimated the attributes of recent care customization strategies. The number of excluded clinical trials involving personalized medicine suggests these represent a dominant area of care customization in the mid-term.

Secondly, although we conducted an extensive literature review using a wide variety of terms capturing customization relevant articles, it is possible some articles may not have been identified. Our decision to include only studies that reported care customization may have excluded studies that addressed patient characteristics analysis in a customized effort, but were not labeled as such, or were not accurately represented in the abstract. To limit the impact of this selection process, we studied bibliographies of selected articles, and added six more relevant articles. We also selected only articles identifying customization strategies (i.e. segmentation analysis that led to a customized intervention) as the driver of this review, and we excluded segmentation initiatives that may have added insights (e.g. patient-profiling questionnaires and machine learning methods). In some cases, it was difficult to assess if segmentation analyses were accompanied by a customized intervention, or to circumscribe the notion of segmentation analysis itself, by comparison with stratification methods. To limit the incorrect exclusion of some articles, investigators discussed these cases. Last, we did not include “grey” literature; including newsletters, professional association or institutional news, and publicity publications. As care delivery

systems and its analysis are not delineated research elements in medicine, this absence may have represented a bias that overlooked recently developed customized strategies, but not yet published. However, the analytical review of bibliographies in each selected articles did not uncover any more relevant information. Third, it is likely our selection process omitted specific research on one of the four customization approach steps, potentially missing important studies. For example, the definition of a “modular package” requires a better understanding of how the range of care and services could be combined into packages, and be pre-grouped as studies have shown (26, 27). The same was also true for related issues such as care customization from regulatory and ethical perspectives (e.g. individual privacy, segmentation and discrimination of sub-populations based on ethnicity). These elements represent interesting research perspective for the future, and can help improve the conceptual of a customized care delivery model.

## Conclusions

This study is the first systematic review to examine current health care customization as a new way of delivering care and services. The analysis shows that there is no common strategy based on a theoretical basis for delivering customized care. Consequently, we have identified three priority areas of research to advance in the development of a common customization delivery model: better define the content of the segmentation analysis and the intervention steps, demonstrate its added value, in particular its economic viability, and align the logics of action that underpin current efforts of customization. It would allow them to use customization to reduce costs and improve quality of care.

## List Of Abbreviations

Cancer-related fatigue: CRF

Children with attention-deficit/hyperactivity disorder: ADHD

Comprehensive Geriatric Assessment: CGA

Electronic health record: EHR

Emergency Department: ED

High needs high costs: HNHC

Individualized care plans: ICPs

Information technology: IT

Lesbian, Gay, Bisexual and Transgender: LGBT

Low Density Lipoprotein: LDL

Mass Customization: MC

Patient-Centered Care: PCC

Preferred Reporting Items for Systematic Reviews and Meta-Analyses: PRISMA

Sickle cell disease: SCD

## **Declarations**

### **Ethics approval and consent to participate**

Not applicable

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The data sets analysed in this study are available from the corresponding author on request.

### **Competing interests**

The authors declare that they have no competing interests.

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No

### **Authors' contributions**

EM and AF made substantial contributions to the study design and drafting of the manuscript. TR made a substantial contribution to preparation of the manuscript. MW designed the study and reviewed the final version of the manuscript. All authors read and approved the final manuscript.

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## Appendix

Appendix 1. **Boolean equation - Web of sciences Search Strategy (Literature search performed: march 2019)**

1. (care customization OR personalized service OR targeting populations OR individualized care)
2. AND (segmentation analysis OR profiling patients OR categorizing patients)
3. AND (patient needs OR patient characteristics OR patient preferences OR population characteristics OR patient demands)
4. limit 1+2+3 to English
5. limit 4 to Article
6. limit 5 to yr=2008-2019

## Supplementary Files

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- [PRISMA ScR Fillable Checklist 10 Sept 2019 em.docx](#)