

Estimating the magnitude of different barriers to dental care for special needs patients: A systematic review

ABSTRACT

Quite often, it is seen that the number of special care individual in the dental OPD/clinics is quite low, as compared to their population. This can be due to specific barriers that restrict them in availing dental treatment. Our aim was to identify different barriers to dental care of persons with special needs through a systematic review and to quantify them. A systematic review was carried out according to PRISMA guidelines. PubMed data was searched with predefined keywords leading to retrieval of 576 records. Full length studies published in English language from 2010 onwards with mention of proportion of persons citing a barrier to dental care were included. Three studies published in peer reviewed journals from other data sources were also identified while retrieving the full length texts. Out of a total of 576 PubMed and three additional records, a total of 22 studies were included in the systematic review. Cost, communication, physical facilities, fear/uncooperativeness, unawareness, distant location/inaccessibility, unwilling dentist, transportation, and difficulty in getting appointment were identified as nine major barriers. Pooled proportions for different barriers ranged from 22.75% (Accessibility; 95%CI = 19.96–25.54) to 44.35% (Communication; 95% CI = 32.63–56.07A). There was a high heterogeneity across different studies for both fixed effects and random effects models. Communication, physical facilities, and unawareness were identified as the three most common barriers showing minimum heterogeneity in random effects model.

Keywords: Barriers, dental care, disability, special healthcare needs

INTRODUCTION

High prevalence of unmet dental needs has been reported in patients with special care need. Even in developed countries, having high awareness and concern about those with special care needs, as many as one-fifth of special care population has unmet dental needs.^[1] In less advanced economies, this prevalence goes much higher reaching to 45% to 60% of population with special needs.^[2] In one study from India, the proportion of those requiring corrective dental treatment is ranged from 0.3% to 46.1% while preventive treatment needs among patients with special needs were reported to be 29%.^[3] The high rates of unmet dental treatment needs in special needs patients indicate the presence of barriers in utilization of dental care services. These barriers could be from both the ends. While on the one end, the dental practitioner has considerations of economic utilization of his practice time, which he fears is affected adversely when attending a special needs


patient. Sometimes, the dental practitioner is disinterested to attend the special needs patients owing to lack of a formal training to do so. On the other hand, the patient reports of multiple barriers including, infrastructural deficiencies, physical, social, and psychological ones.

**BHASKAR AGARWAL, SHITIJ SRIVASTAVA¹,
ABHINAV SHEKHAR¹, KSHITIJ ARORA, MAYANK SINGH,
LAKSHYA KUMAR**

Department of Prosthodontics, King George's Medical University, ¹Department of Prosthodontics, Sardar Patel PGI of Medical and Dental Sciences, Lucknow, Uttar Pradesh, India

Address for correspondence: Dr. Bhaskar Agarwal, Professor JGr, Department of Prosthodontics, King George's Medical University, Lucknow - 226 003, Uttar Pradesh, India. E-mail: bhaskaragarwal2@gmail.com

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Barriers restrict the dental care services utilization, and their proper understanding will help in modulating the dental practice into a special needs patient-friendly facility. Unfortunately, the list of different barriers is lengthy, and no single study is able to assess all the barriers to dental care among patients with special needs. A number of studies to identify such barriers have been carried out. However, the process of identification of barriers has not been uniform in all the studies. Moreover, there is difference in the magnitude of effect of a barrier in different studies. The reason for this could be difference in different sociocultural and environmental variables in different studies. A few systematic reviews have tried to identify these barriers and to highlight the most important barriers. Two recent systematic reviews have identified difficulties of physical inaccessibility, lack of access to information among caregivers, lack of knowledge of disability issues, and low experience and skills, dentist's unwillingness and fear^[4,5] as the barriers; however, these studies have not identified the magnitude of each of these barriers independently in order to provide a basis for the formulation of an effective strategy.

Hence, the present systematic review was carried out with the research question, "Can the burden of barriers to dental care in persons with special need be quantified, if yes, then what is the burden of different barriers?"

MATERIAL AND METHOD

This systematic review used a meta-analytical approach using Apriori protocol according to PRISMA guidelines and was registered (No. CRD4202123778)

Search Strategy: Online data on PubMed was searched with key phrases "difficulties in dental care to special needs patients," "barriers to dental treatment of disabled," "barriers to dental treatment of special needs," "Impediments to dental treatment of special care group." Following were the inclusion and exclusion criteria:

Inclusion Criteria: Only articles published in English language identifying barriers to dental health care to patients with special care needs (having physical and/or mental care needs), both adults and children published from 2010 onwards.

Exclusion Criteria: Review studies, theme assessments, studies reporting barriers to dental care-seeking pattern, studies where full-length articles could not be retrieved, having qualitative assessment only were excluded from the assessment. Studies failing to meet Joanna Briggs' critical appraisal tool checklist were also excluded.

Screening, Short listing, and Quality Check: A total of 576 entries were retrieved (using the above key phrases).

Records removed before screening as they were duplicate or had other issues were 110. After abstract reading of 466 articles, a total of 75 entries published in the year 2010 or above were shortlisted. Full-length articles were searched for these 75 entries. Three entries from other sources (other than PubMed) were also made while Google Search for full-length articles, thus making the total to 78. However, full-length articles could not be retrieved for four records, and thus, they were excluded from the study. Out of the remaining 74 entries, a total of 31 articles having full details regarding the barriers in dental health seeking were included in the assessment after quality check using Joanna Briggs' critical appraisal tool by two of the authors. Studies where there was a disagreement between the two authors, it was referred to the principal author (BA) and his appraisal was considered to be final. The profile of patients included in the study was noted. There were some qualitative studies (n = 9) that reported of barriers in terms of major themes, while some other studies specifically mentioned about the barriers affecting the dental care-seeking pattern of the special needs group patients. They were also excluded from our review. Finally, a total of 22 studies were included in the systematic review [Table 1; Figure 1].^[3,6-26]

Identification of Major Barriers: Studies reporting results in quantitative terms were shortlisted separately for the purpose of meta-analysis. Similar terms such as affordability, financial difficulty, cost, and expensive were categorized into one barrier—"Cost." Only those barriers mentioned in at least three studies were included in the study and were termed as major barriers. A total of nine major barriers were identified, viz.

- Cost—Included highlighting of affordability, financial difficulty, cost, expensiveness as the barrier to treatment.
- Communication—Difficulty in communicating with the staff of dental facility. Difficulty in following instructions given by the dental care provider.
- Physical facilities (infrastructure/accommodation)—Difficulty in movement, sitting, space, etc.
- Fear/Uncooperativeness—Perception of fear (instrument, medication, dental care provider, staff) and/or inability of patient to cooperate with the dental care facility personnel.
- Unawareness—Lack of knowledge regarding the existence of a dental care facility, its working hours, its facilities, and/or lack of knowledge regarding a dental practitioner who could attend the patients with special needs.
- Distant location/accessibility—When the patient

Table 1: Characteristics of the studies included in the meta-analysis

Author (Year), Place	Study Design	Sample size and characteristic	Barriers Identified
Rapalo et al. (2010), ^[6] USA	Population study	8,845; 47.2% males; > 18 yrs; Multiethnic	Cost (30.1%) – could not visit a dentist owing to cost factor
Yuen et al. (2010), ^[7] USA	Cross-sectional	192 Spinal cord injury patients; 43.9 Yrs (19 to 83 yrs); 59.9% males; 77.6% Caucasians	High cost (40.1%), physical barriers (22.9%), dental fear (15.1%), wheelchair inaccessibility (29.5%), lack of transportation (9.4%)
Rouleau et al. (2011), ^[8] USA	Cross-sectional (Correspondence)	344 (49.8 Years; 48.3% males), Multi-ethnic; 28.7% Spinal cord injury; 15.6% brain injury, 10.7% Stroke)	Financial issues (27/41; 65.85%); physical accessibility
Al Habashneh et al. (2012), ^[9] Jordan	Cross-sectional	103 Down syndrome children (Mean age 13.66 Yrs; 66% males)	Unawareness regarding children’s dental problems (61.2%), non-awareness regarding importance of visit to a dentist (40.9%), fear (32.3%), Financial (32.3%)
Leroy and Declerck (2013), ^[10] Belgium	Cross-sectional	656 22-65 yrs	Barriers – Overall (42%), Fear (37%), and Financial and transportation (29%) were the two major barriers
Barry et al. (2014), ^[11] UK	Cross-sectional case-control	56 (9.82 years); 76.8% males Autism Patients	Transportation Difficulty (42.8%), waiting (64.3%), Sudden change in Child’s behavior (89.3%)
Leal Rocha et al. (2015), ^[12] Brazil	Cross-sectional	204 (3 to 97 yrs)- Mean age 39.8 Yrs; (51% Motor disability; 36.8% hearing, 12.% Visual impairment)	Unawareness (45%), Inadequate infrastructure (37.3%), transport difficulty (31.4%), Unsafe surroundings (23.5%), Need of escort (71.6%), Long waiting time (35.8%)
Shyama et al. (2015), ^[13] Kuwait	Cross-sectional	298 (211 Phys.; 97 Down’s S)	Difficulty to get an appointment (37.3%); Difficulty in cooperation (34.7%), 48% did not consider dental services to be good/excellent
Williams et al. (2015), ^[14] USA	Cross-sectional (Survey in schools)	107 3-26 Yrs	Dentist willing to treat (34.2%), finances (17.6%), wait time (14.4%), distance (12.4%), and transportation (1.9%). Increasing age was a barrier in finding a dentist willing to treat
Gerreth and Borysewicz-Lewicka (2016), ^[15] Poland	Cross-sectional Correspondence	264 Parents of Special Needs children	Protracted waiting time (36.7%), Dentist not giving next appointment (46.2%), Unwilling Dentist (18.2%), No awareness of where to report (18.2%), Expensive (17.4%)
Bhaskar et al. (2016), ^[3] India	Cross-sectional	331 (6-14 Yrs), 64.7% Males	Financial difficulty (68.6%), Distant location (33.2%), Lack of cooperation (30.5%), Fear (26.9%), Transportation difficulty (19%), Unwilling dentist (5.4%)
Vogan et al. (2017), ^[16] Canada	Cross-sectional	40 Autism spectrum disorder (ASD) adults Mean age 35.88 Yrs; 45% Males. Multiple ethnicities	Lack of awareness regarding the dental facility (65.8%), Steps to seek help are too overwhelming (52.6%), Negative experience in past (47.4%), Communication issues (47.4%), Considering the problem not to be serious enough (42.1%)
Vertel et al. (2017), ^[17] Canada	Cross-sectional Multiethnicity	50 (2-21 Yrs; 10.2 Yrs); 50% Male	Ever refused treatment (50%), Location, coordination of appointments, waiting time (5 months), financial reasons
Sabbarwal et al. (2018), ^[18] India	Cross-sectional	100 Down syndrome children (Mean age 10.64 yrs); 57% males	Difficulty owing to disability (26%), accessibility (40%), dentist-related factors (45%) Fear (2.77/3=92.33%); Attitude (1.06/3=35.3%), Awareness (0.97/3=32.3%), Cost (0.82/3=27.3%)
Mielnik-Błaszczak et al. (2018), ^[19] Poland	Cross-sectional (Epileptic)	107 6-18 Yrs	Dentist’s refusal (48.15%), Long wait and queues (31.48%), architectural constraints and high cost (31.48% each), Dentist clinic too far away (25.18%), Lack of awareness regarding facility (14.81%), Mental retardation, Country or village residence
Dougall et al. (2018), ^[20] Multinational Multicentric	Cross-sectional	246 16 to 92 yrs (Mean age 35.89 yrs); 57.7% males	Transportation (73.7%), Social security services, systems and policies (86.9%), General social support (73.8%), Health services, systems and policies (86.9%), Labor and employment services, systems and policies (75.4%)
Hall et al. (2018), ^[21] USA	Cross-sectional	186 Serious mental illness (Mean age 45.25 Yrs; 18-83 Yrs); 31.7% Males	Low education, Comorbid physical condition, Diabetes, Respiratory disease, Smoking habit, Edentulousness Cost (39%), Lack of perceived need (22%), Uncertainty about coverage or difficulty accessing providers (12.5%), Avoiding due to anticipated problems (8%), Fear (7.4%), Transportation (2.7%)
Sermuti-Anuwat et al. (2018), ^[22] Thailand	Cross-sectional	33 adults using wheel-chairs; Median age 49 years; 42.4% males	Accessibility (78.8%), Denial by dentist (75.8%), Discrimination and insecurity (72.7%), Cost (82%), Accommodation (75.8%), Awareness (75.8%)
Lim (2019), ^[23] Singapore	Case-series, Multiethnic	55 aged 24-105 yrs (Mean age 61.9 yrs); 67.3% males	Communication (41.9%), Cooperation (20%), medical status (76.3%), oral risk factors (78.2%), accessibility (37.9%), Legal and ethical barriers (3.64%)
Zhou et al. (2020), ^[24] Hong Kong	Cross-sectional	383 Children	Expensive (33.2%), Hard to find willing dentists (28.2%), Incompetent dental staff (22.7%), Unavailability at nearby places (20.9%) Uncooperative child (56.3%), Too young age (39%), fear (35%), Parental anxiety (20.2%)

Contd...

Table 1: Contd...

Author (Year), Place	Study Design	Sample size and characteristic	Barriers Identified
Teo et al. (2020), ^[25] Singapore	Cross-sectional multi-ethnic	29 (18-59 years; Mean age 31.3 yrs); 62.1% males	Communication (44.8%), Ability to Cooperate (20.65%), Medical issues (27.6%), Oral risk factors (51.6%), Accessibility (34.5%), Legal and ethical issues (6.9%)
Alfaraz et al. (2021), ^[26] Saudi Arabia	Cross-sectional Caregivers	186 Patients; 67.2% Males; Dev. Disability (44.6%)	Lack of time on part of caregivers (60.8%), unsuitable clinic environment (53.9%), difficulties with transportation (51.9%), medical/health status of the patient (51%), distant clinic (51%)

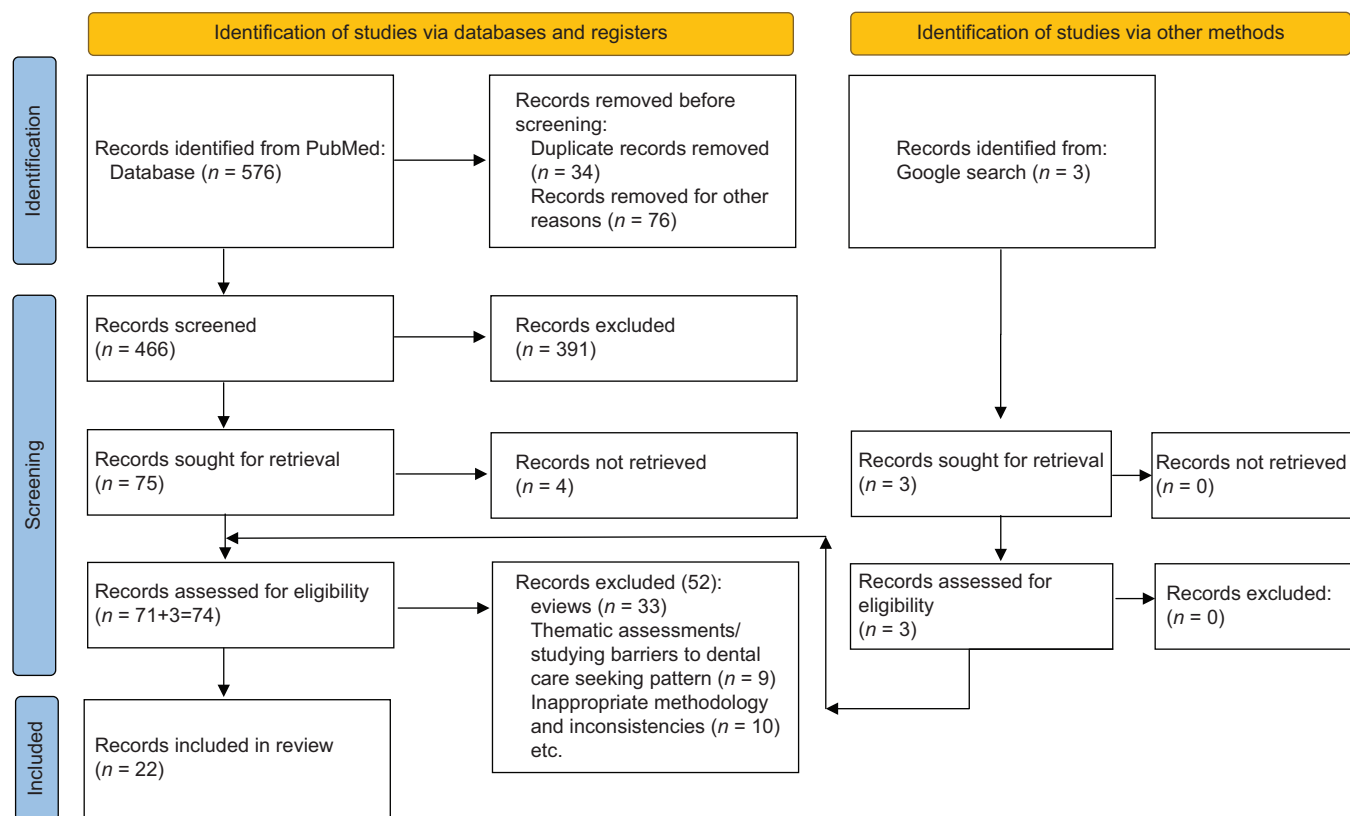


Figure 1: PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers, and other sources

expressed distance or accessibility between place of residence and dental care facility as the barrier, the accessibility might include difficulty in getting appointment at a suitable time but does not include transportation difficulty which was reported as a separate barrier. Location of dental care facility at a place where there were inadequate arrangements for special care needs patient to go was also included as this barrier.

- Unwilling dentist—When the dentist expressed inability/unwillingness or showed disinterest to attend a special needs patient.
- Transportation—When lack of availability of means of transport was cited as the barrier.
- Difficulty in getting appointment/long waiting time.

Some barriers were found to be repetitive in a study, for example, physical barriers and wheelchair accessibility as reported by Yuen et al. (2010)^[7] in their study, which have

been included as physical barriers in our assessment. For such barriers, the arithmetic mean of two or more barriers was considered as the representative value. For each of the selected barrier, proportions of patients reporting it as a barrier in individual study were tabulated and pooled burden was calculated. Heterogeneity among studies was evaluated using fixed effects as well as random effects models.

Data analysis

The data analysis was done using the method described by Neyeloff et al.^[27] MS-Excel 2013 was used to perform the calculations and for plotting the forest plots.

RESULTS

Cost: A total of 13 studies reported the cost as a barrier [Table 2a]. In different studies, the proportion of patients reporting cost

as a barrier ranged from 17.40% (95% CI = 12.83–21.97%)^[14] to as high as 82% (95% CI = 68.89–95.11%).^[22] The pooled proportion of patients reporting cost as a barrier was calculated as 32.30% (95% CI = 31.46–33.14%). In fixed effect model, the calculated heterogeneity was 94.50%; however, in random effects model the observed heterogeneity was 55.24%. Thus, both fixed effect and random effect models showed a high heterogeneity, thus indicating that the projection of cost as a barrier is perceived heterogeneously in different environments.

Communication: Quantified responses regarding recognition of communication as a barrier were seen in three studies only [Table 2b]. Vogan *et al.* (2017),^[16] Lim *et al.* (2019)^[23], and Teo *et al.* (2020)^[25] reported it in 47.4%, 41.9%, and 44.8% cases, respectively. Overall pooled proportion was 44.35% (95% CI = 32.63–56.07%). The negative I^2 value depicted the absence of heterogeneity among the studies ($I^2=1164.49$).

Physical barriers (infrastructure/accommodation): Infrastructure and physical facilities were reported as quantified barriers in four studies [Table 2c]. Yuen *et al.* (2010),^[7] Leal Rocha *et al.* (2015),^[12] Mielnik-Blaszczak *et al.* (2018)^[19], and Alfaraj *et al.*(2021)^[26] reported its proportion as 26.2%, 37.3%, 31.48%, and 53.9%, respectively. Pooled proportion was calculated as 37.78% (95% CI = 33.19–42.37%). On checking the heterogeneity, fixed effects model showed it to be 83.97% ($p < 0.001$). However, random effects model showed it to be 6.29% only ($p = 0.361$), thus showing that considering random effects to play a role there was a marked consistency among studies.

Fear/Uncooperativeness: Data related to fear/uncooperativeness was quantified in ten studies [Table 2d]. Proportion of patients experiencing fear/uncooperativeness ranged from 7.4% (95% CI 3.49–11.31%)^[21] to 92.33% (95%CI = 73.50–111.16%).^[17] The pooled proportion was 37.25% (95% CI = 34.61–39.89%). There was a marked heterogeneity among studies on fixed effects model ($Q = 248.58$; $I^2 = 96.37$; $P < 0.001$); however, on random effects model the heterogeneity among studies reduced substantially ($Q = 14.60$; $I^2 = 38.36$; $P = 0.010$).

Unawareness/Lack of knowledge: A total of seven studies had quantified data related with unawareness/lack of knowledge as the barrier [Table 2e]. Among these, the proportion of patients reporting unawareness/lack of knowledge as barrier ranged from 18.2% (95% CI = 13.05–23.35)^[14] to 75.8% (95% CI = 46.09–105.51%),^[19] thus showing an extreme variability among different studies. The pooled proportion was 37.27% (95% CI = 33.17–41.37%). On fixed effects model, there was a marked heterogeneity among studies ($Q = 57.73$;

$I^2 = 89.61$; $P < 0.001$). However, on random effects model, the heterogeneity was reduced substantially ($Q_v = 5.99$; $I_v^2 = -0.106$); $P = 0.424$).

Distant location/accessibility: A total of seven studies quantified distant location/accessibility as the barrier to dental care of special needs patients [Table 2f]. Proportion of patients reporting it as a barrier ranged from 12.4% (95% CI: 6.02–18.78%)^[14] to 37.9% (95% CI = 21.63–54.17%).^[23] Pooled proportion was calculated as 22.75% (95% CI = 19.96–25.54%). On fixed effects model, there was a large heterogeneity among studies ($Q = 23.07$; $I^2 = 73.99$; $P < 0.001$). However, on random effects model, this heterogeneity was found to be reduced substantially ($Q_v = 8.80$; $I^2 = 31.88$; $P = 0.185$).

Unwilling dentist: A total of seven studies quantified dentist's unwillingness as the barrier [Table 2g]. The proportion of patients reporting dentist's unwillingness as a barrier ranged from 5.4% (95% CI = 2.90–7.90)^[15] to 48.15% (95% CI = 35.00–61.30%).^[19] Pooled proportion was 24.81% (95% CI = 22.15–27.47%). On fixed effects model, there was high heterogeneity among studies ($Q = 149.41$; $I^2 = 95.98$; $P < 0.001$); however, on random effects model there was substantial reduction in heterogeneity ($Q_v = 5.85$; $I_v^2 = -2.63$; $P = 0.441$).

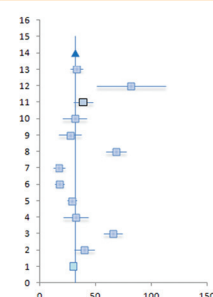
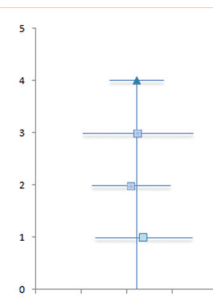
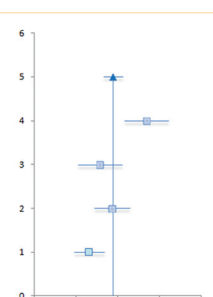
Transportation issues: Quantified outcomes regarding transportation difficulty as a barrier to treatment were reported by nine studies [Table 2h]. Proportion of patients reporting it as a barrier ranged from 1.9% (95%CI = -0.60–4.40%)^[14] to 73.7% (95% CI = 62.97–84.43%).^[20] Pooled proportion was 29.64% (95% CI = 27.35–31.93%). On fixed effects model, the heterogeneity among studies was found to be quite high ($Q = 414.47$; $I^2 = 98.06$; $P < 0.001$). Though random effects model resulted in substantial reduction of heterogeneity ($Q_v = 16.69$; $I^2 = 52.08$; $P = 0.441$), it was still very high.

Difficulty in getting appointments/long waiting time: This data could be extracted from six studies [Table 2i]. Proportion of patients indicating it to be a barrier ranged from 14.4% (95% CI = 7.52–21.28%)^[14] to 64.3% (95% CI = 43.30–85.30%).^[11] Pooled proportion was 31.48% (95% CI = 28.08–34.88%). On evaluating the data for heterogeneity in studies using fixed effects model, high heterogeneity was observed ($Q = 38.81$; $I^2 = 87.11$; $P < 0.001$). On random effects model, this heterogeneity was seen to be reduced substantially ($Q_v = 6.70$; $I_v^2 = 25.44$; $P = 0.243$).

DISCUSSION

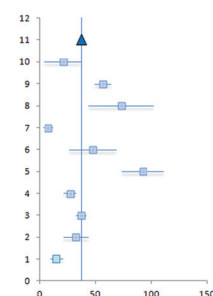
Patients with disabilities, *i.e.*, special need patients, generally have a compromised quality of life owing to

Table 2: Studies reporting different barriers in dental treatment of special needs patients

SN	Study	Sample size	%	95% Confidence intervals		Forest plot
				Lower Bound	Upper Bound	
(a) Cost (n=13)						
1.	Rapalo et al. (2010) ^[7]	8845	30.50	29.54	31.46	 <p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Yuen et al. (2010) ^[7]	192	40.10	33.17	47.03	
3.	Rouleau et al. (2011) ^[8]	344	65.80	60.79	70.81	
4.	Al Habashneh et al. (2012) ^[9]	103	32.30	23.27	41.33	
5.	Leroy and Declerck (2013) ^[10]	656	29.00	25.53	32.47	
6.	Williams et al. (2015) ^[14]	385	17.60	13.80	21.40	
7.	Gerreth and Borysewicz-Lewicka (2016) ^[15]	264	17.40	12.83	21.97	
8.	Bhaskar et al. (2016) ^[3]	331	68.60	63.60	73.60	
9.	Sabbarwal et al. (2017) ^[18]	100	27.30	18.57	36.03	
10.	Mielnik-Błaszczak et al. (2018) ^[19]	107	31.48	22.68	40.28	
11.	Hall et al. (2018) ^[21]	186	39.00	31.99	46.01	
12.	Sermsuti-Anuwat et al. (2018) ^[22]	33	82.00	68.89	95.11	
13.	Zhou et al. (2020) ^[24]	383	33.20	28.48	37.92	
14.	Pooled	11929	32.30	31.46	33.14	
Cochran's Q=218.02; I ² =94.50 (Fixed effects); P<0.001						
Cochran's Q _v =26.81; I _v ² =55.24 (Random effects); P=0.008						
(b) Communication (n=3)						
1.	Vogan et al. (2017) ^[16]	40	47.4	26.06	68.74	 <p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Lim et al. (2019) ^[23]	55	41.9	24.79	59.01	
3.	Teo et al. (2020) ^[25]	29	44.8	20.44	69.16	
4.	Pooled	124	44.35	32.63	56.07	
Cochran Q=0.158; I ² =-1164.49; P=0.924 (Fixed effects)						
Cochran Q _v =-1.489; I _v ² =234.49; P=NA (Random effects)						
(c) Physical Facilities/Infrastructure (n=4)						
1.	Yuen et al. (2010) ^[7]	192	26.2	18.96	33.44	 <p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Rocha et al. (2015) ^[12]	204	37.3	28.92	45.68	
3.	Mielnik-Błaszczak et al. (2018) ^[19]	107	31.48	20.85	42.11	
4.	Alfaraj et al. (2021) ^[26]	186	53.9	43.35	64.45	
5.	Pooled	689	37.78	33.19	42.37	
Cochran Q=18.71; I ² =83.97; P<0.001 (Fixed effects)						
Cochran Q _v =3.20; I _v ² =6.29; P=0.361 (Random effects)						

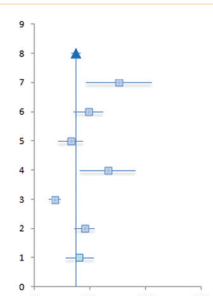
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Table 2: Contd...

SN	Study	Sample size	%	95% Confidence intervals		Forest plot
				Lower Bound	Upper Bound	
(d) Fear (n=10)						
1.	Yuen et al. (2010) ^[7]	192	15.1	9.60	20.60	 <p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Al Habashneh et al. (2012) ^[9]	103	32.3	21.32	43.28	
3.	Leory and Declerck (2013) ^[10]	656	37	32.35	41.65	
4.	Bhaskar et al. (2016) ^[3]	331	26.9	21.31	32.49	
5.	Sabbarwal et al. (2018) ^[18]	100	92.33	73.50	111.16	
6.	Vogan et al. (2017) ^[16]	40	47.4	26.06	68.74	
7.	Hall et al. (2018) ^[21]	186	7.4	3.49	11.31	
8.	Sermutsi-Anuwat et al. (2018) ^[22]	33	72.8	43.69	101.91	
9.	Zhou et al. (2020) ^[24]	383	56.3	48.79	63.81	
10.	Teo et al. (2020) ^[25]	29	20.65	4.11	37.19	
11.	Pooled	2053	37.25	34.61	39.89	

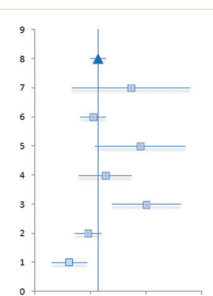
Cochran Q=248.58; I²=96.37; P<0.001 (Fixed effects)

Cochran Q_v=14.60; I²=38.36; P=0.0102 (Random effects)

(e) Unawareness/Lack of knowledge (n=7)						
1.	Al Habashneh et al. (2012) ^[9]	103	40.9	28.55	53.25	 <p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Rocha et al. (2015) ^[12]	204	45	35.79	54.21	
3.	Gerreth and Borysewicz-Lewicka (2016) ^[15]	264	18.2	13.05	23.35	
4.	Vogan et al. (2017) ^[16]	40	65.8	40.66	90.94	
5.	Sabbarwal et al. (2018) ^[18]	100	32.3	21.16	43.44	
6.	Mielnik-Błaszczak et al. (2018) ^[19]	107	48.15	35.00	61.30	
7.	Sermutsi-Anuwat et al. (2018) ^[22]	33	75.8	46.09	105.51	
8.	Pooled	851	37.27	33.17	41.37	

Cochran Q=57.73; I²=89.61; P<0.001 (Fixed effects)

Cochran Q_v=5.99; I²=-0.165; P=0.424 (Random effects)

(f) Accessibility (n=7)						
1.	Williams et al. (2015) ^[14]	117	12.4	6.02	18.78	 <p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Bhaskar et al. (2016) ^[3]	331	19	14.30	23.70	
3.	Sabbarwal et al. (2018) ^[18]	100	40	27.60	52.40	
4.	Mielnik-Błaszczak et al. (2018) ^[19]	107	25.18	15.67	34.69	
5.	Lim (2019) ^[23]	55	37.9	21.63	54.17	
6.	Zhou et al. (2020) ^[24]	383	20.9	16.32	25.48	
7.	Teo et al. (2020) ^[25]	29	34.5	13.12	55.88	
8.	Pooled	1122	22.75	19.96	25.54	

Cochran Q=23.07; I²=73.99; P<0.001 (Fixed effects)

Cochran Q_v=8.80; I²=31.88; P=0.185 (Random effects)

Contd...

Table 2: Contd...

SN	Study	Sample size	%	95% Confidence intervals		Forest plot
				Lower Bound	Upper Bound	
(g) Unwilling Dentist (n=7)						
1.	Williams et al. (2015) ^[14]	117	34.2	23.60	44.80	<p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Gerreth and Borysewicz-Lewicka (2016) ^[15]	264	18.2	13.05	23.35	
3.	Bhaskar et al. (2016) ^[3]	331	5.4	2.90	7.90	
4.	Vertel et al. (2017) ^[17]	50	50	30.40	69.60	
5.	Sabbarwal et al. (2018) ^[18]	100	45	31.85	58.15	
6.	Mielnik-Blaszczak et al. (2018) ^[19]	107	48.15	35.00	61.30	
7.	Zhou et al. (2020) ^[24]	383	28.2	22.88	33.52	
8.	Pooled	1352	24.81	22.15	27.47	
<p>Cochran Q=149.41; I²=95.98; P<0.001 (Fixed effects) Cochran Q_v=5.85; I²=-2.63; P=0.441 (Random effects)</p>						
(h) Transportation Difficulty (n=9)						
1.	Yuen et al. (2010) ^[7]	192	9.4	5.06	13.74	<p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Leroy and Declerck (2013) ^[10]	656	29	24.88	33.12	
3.	Barry et al. (2014) ^[11]	56	42.8	25.67	59.93	
4.	Rocha et al. (2015) ^[12]	204	31.4	23.71	39.09	
5.	Williams et al. (2015), USA ^[14]	117	1.9	-0.60	4.40	
6.	Bhaskar et al. (2016) ^[3]	331	19	14.30	23.70	
7.	Dougall et al. (2018) ^[20]	246	73.7	62.97	84.43	
8.	Hall et al. (2018) ^[21]	186	2.7	0.34	5.06	
9.	Alfaraz et al. (2021) ^[26]	186	51.9	41.55	62.25	
10.	Pooled	2174	29.64	27.35	31.93	
<p>Cochran Q=414.47; I²=98.06; P<0.001 (Fixed effects) Cochran Q_v=16.69; I²=52.08; P=0.441 (Random effects)</p>						
(i) Difficulty in getting appointment/long waiting time (n=6)						
1.	Barry et al. (2014) ^[11]	56	64.3	43.30	85.30	<p>Triangular solid fill represents pooled proportion Serial numbers at Y-axis depict corresponding study</p>
2.	Rocha et al. (2015) ^[12]	204	35.8	27.59	44.01	
3.	Shyama et al. (2015) ^[13]	298	37.3	30.37	44.23	
4.	Williams et al. (2015), USA ^[14]	117	14.4	7.52	21.28	
5.	Gerreth and Borysewicz-Lewicka (2016) ^[15]	264	36.7	29.39	44.01	
6.	Mielnik-Blaszczak et al. (2018) ^[19]	107	31.48	20.85	42.11	
7.	Pooled	1046	31.48	28.08	34.88	
<p>Cochran Q=38.81; I²=87.11; P<0.001 (Fixed effects) Cochran Q_v=6.70; I²=25.44; P=0.243 (Random effects)</p>						

loss of opportunities, issues related with physical and mental health as well as in personal care and hygiene. Dental health care is also one of the areas where special need patients face adversities. They have a high burden of unmet dental care needs.^[10,18,28,29] They are often denied

dental treatment,^[17] dental practitioners avoid treating them^[3,14,15,17] and even if they receive the treatment, it is not satisfactory.^[16,19] To bring these patients at par with the otherwise healthy population, it is essential that the barriers posing difficulties in their ability to avail the

dental treatment should be identified and cleared with formulation of appropriate strategies.

The identification of such barriers has not always been done in quantitative terms. A number of studies have focused on qualitative analysis only, thus highlighting some of the key barriers without quantifying that problem. Sagheri *et al.*^[30] in a qualitative assessment identified demands related with resources/cost, low priority to oral health, lack of confidence/fear, and negativity of professionals as the possible barriers. Montini *et al.*^[28] in another study among community living elderly recognized finances, transportation, and accessibility as the barriers. Parish *et al.*^[29] in another study among HIV patients identified dental anxiety and fear, cumbersome administrative procedures, long waits at dental office, problem-focused care-seeking habit, transportation difficulties, dentist's reluctance to treat, and psychological issues as the barriers. In a recent study, Wright *et al.*^[31] identified access to dental care, fear, characteristics of mental illness, lack of oral health screening, lack of education and training, stigma of mental illness, and communication as the barriers to dental care among mentally ill patients.

Although qualitative assessments help to identify the areas of deficiency, however, they do not provide a quantitative measure of the problem, thus reducing the scope for appropriate strategy formulation which is dependent not only on the identification of problem areas but also on the magnitude of each problem area.

One of the problems in understanding the magnitude of different barriers is a high diversity in different studies. For example, the proportion of respondents perceiving cost as a barrier was as low as 17.4% in the study by Gerreth and Borysewicz-Lewicka (2016)^[15] as compared to as high as 82% in the study by Sermsuti-Anuwat *et al.* (2018).^[22] Such a high diversity is often confusing and is itself a barrier in the formulation of appropriate strategies to reduce the barriers in general. Similar high diversities were also revealed for other identified barriers too. Considering the heterogeneity in different studies regarding the magnitude of different barriers, it is essential that through the help of pooled analysis of differences in different studies, an idea regarding average burden of each of these burdens should be identified. Hence, this systematic review was done.

In this review, we focused our work primarily on nine major barriers, *viz.* cost, communication, physical barriers, fear/uncooperativeness, unawareness, distant location/accessibility, unwilling dentist, transportation, and difficulty in getting appointment/long waiting time. These identified

barriers were shortlisted not only from previous systematic reviews^[4,5] but were also highlighted in some of the previous studies focusing on qualitative assessment.^[28-32] Moreover, data related to these barriers was available in a number of studies. For the purpose of current study, we carried out meta-analysis of data if there were at least three studies in which quantitative data for the identified outcome was available.

In this review, pooled burden of cost, communication, physical facilities/infrastructure, fear, unawareness/lack of knowledge, accessibility, dentist's unwillingness, transportation difficulty, difficulty in getting appointment/long waiting time were calculated as 32.30% (95% CI = 31.46–33.14%), 44.35% (95% CI = 32.63–56.07%), 37.78% (95% CI = 33.19–42.37%), 37.25% (95% CI = 34.61–39.89%), 37.27% (95% CI = 33.17–41.37%), 22.75% (95% CI = 19.96–25.54%), 24.81% (95% CI = 22.15–27.47%), 29.64% (95% CI = 27.35–31.93%), 31.48% (95% CI = 28.08–34.88%), respectively. Thus, showing that of different identified barriers communication had the most important role as a barrier while accessibility and dentist's unwillingness were the least affecting barriers. Compared to our assessment, Ummer-Christian *et al.*^[5] and Krishnan *et al.*^[4] in their studies recognized did not find communication to be a potent barrier. In this review, we found dentist's unwillingness among the least important barriers; however, Krishnan *et al.*^[4] identified dentist's unwillingness and fear as the most potential barriers. One of the reasons for discrepancy in current review and that of previous systematic reviews was the fact that the current study focused on the pooled analysis of magnitude of burden of each of these barriers while previous studies generally made a qualitative assessment.

In current review, one of the issues was high heterogeneity among studies. The I^2 value was generally greater than 50% for most of the barriers studied when evaluated in fixed model. For fixed models, only communication was the barrier that resulted in a low I^2 value ($= -1164.49 \approx 0\%$), thus highlighting that communication had a homogeneous impact in different studies. On choosing the random effects models too, the heterogeneity did not go below 50% for barriers cost and transportation difficulty. One of the reasons for this could be the fact that the impact of cost in different environments was variable. The meta-analysis included patients from different parts of the world representing different economies and different per capita income profiles, which might have affected the affordability. Moreover, the health policies in different countries have different financial impact on a patient. In some countries, state bears the cost, while in some other countries it is the insurance company that bears

the cost. There are some countries where no such state or insurance reimbursement is available, and hence, the burden of cost could be heterogeneous in different environments. Similar is the impact of transportation, which might be attributed to difference in transport facilities in different environments.

Reduction in heterogeneity on adopting random effect models in turn showed that the burden of different barriers might be governed randomly. However, this randomness could be attributed to the difference in socioeconomic profile, social, and employment commitments of caregivers and their priorities. Moreover, diversity in nature of disability of patients in different studies could also be a driving factor. Despite these differences, this review tries to give an idea about the average burden of different barriers affecting the dental care of special needs groups. Some suggested strategies to overcome the barriers identified could be:

For cost, the coverage of dental treatment for special needs group could be done by the state, under schemes like Ayushman Bharat (in India). Corporate sponsorship of dental treatment for special needs patients must also be looked upon as an alternative.

For communication, special CMEs and programs for dental practitioners should be organized to help them communicate effectively with special needs patients.

For physical barriers, regulatory authorities must ensure that dental practice facilities should be special needs patient-friendly. Special incentives could be offered to facilities making their physical setup compatible to special needs patients.

For fear/uncooperativeness, 1. Special CMEs and programs for dental practitioners should be organized to help them communicate effectively with patients with special needs. 2. Regulatory authorities must initiate accreditation and rating of facilities based on their cooperativeness to attend special needs patients.

For unawareness/lack of knowledge, State must use mass media to create awareness among public regarding the dental conditions faced by special needs patients and to spread awareness regarding the accredited facilities offering treatment to special needs patients.

For distant location/accessibility, the state must launch accreditation and incentive schemes of facilities located

within 5 to 10 km range. Special encouragements for accredited practitioners (accredited for serving special needs patients) establishing facilities at locations where such facilities are not available should be given by issuing directives to financial institutions and by offering tax relaxation.

For transportation issues, public and corporate transport carriers must be encouraged to provide discount to special needs travelers in turn they could get some exemption in taxes.

For difficulty in getting appointments/long waiting time, it can be handled by creation of more facilities and making number of special needs patients attended by a dental facility as the criteria for accreditation/ranking.

CONCLUSION

The findings in the present study showed that communication, physical facilities, and lack of awareness were the three major barriers in the path of dental care to patients with special care. Hence, it is recommended that specific dental facilities targeted to attend the patient with special needs should not only be developed but should also be made patient-friendly by adopting specific communication modes and modification/alteration of physical facilities as per special care need patients. Unfortunately, dental practitioners in a large part of world do not place special care need patients as a priority group, there should be motivation for doing so by appropriate state incentives. Moreover, use of mass media to make the special need patients aware regarding existence of such facilities should also be initiated with the help of organized steps and state interventions. The present study has certain limitations owing to high heterogeneity in study populations and highlighted barriers in different studies. There is need to study the barrier burden in a more systematic way in order to quantify the burden of each barrier in order to formulate appropriate strategies to reduce them.

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Conflicts of interest

There are no conflicts of interest.

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