

BMJ Open Perceptions of generic medication in the general population, doctors and pharmacists: a systematic review

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ABSTRACT

Objective: To investigate negative perceptions about generic medicines and evaluate the proportions of lay people, doctors and pharmacists who hold these perceptions.

Design: A systematic review of observational studies.

Data sources: MEDLINE, EMBASE, PsycInfo and Scopus.

Eligibility criteria: Quantitative data from cross-sectional and prospective studies published in English after 1980, using self-report measures to evaluate perceptions about generic medicines, presented as percentages of the total sample assessed.

Results: After screening 2737 articles, 52 articles were included in the final analysis. A high proportion of doctors, pharmacists and lay people had negative perceptions of generics. Lay people were significantly more likely to view generics as less effective than branded medication (35.6%, 95% CI 34.8% to 36.4%) compared to doctors (28.7%, 27.5% to 29.9%) and pharmacists (23.6%, 21.2% to 26.2%), $p < 0.0001$. Pharmacists (33.4%, 31.0% to 35.9%) were significantly more likely to believe generics were of inferior quality compared to branded medication than were doctors (28.0%, 26.3% to 29.9%), $p = 0.0006$, and lay people (25.1%, 24.2% to 26.0%), $p < 0.0001$. Doctors believed generics caused more side effects than branded medication (24.4%, 22.2% to 26.9%), compared to pharmacists (17.6%, 15.3% to 20.1%) and lay people (18.8%, 17.8% to 19.8%), $p < 0.0001$. Doctors (28.5%, 26.9% to 30.2%) and pharmacists (25.4%, 21.4% to 29.9%) had significantly more safety concerns about generics than did lay people (18.0%, 17.0% to 19.0%), $p \leq 0.0002$. A greater proportion of lay people felt negatively about generic substitution (34.0%, 33.2% to 34.9%), compared to doctors (24.1%, 22.0% to 26.4%) and pharmacists (11.0%, 9.6% to 12.7%), $p < 0.0001$. Rates of negative perceptions of generics do not appear to have changed substantially over time in the general population or among physician groups, $p \geq 0.431$, but such negative beliefs show a decreasing trend in pharmacists over the study period, $p = 0.034$.

Conclusions: A significant proportion of doctors, pharmacists and lay people hold negative perceptions of generic medicines. It is likely these attitudes present barriers to the wider use of generics.

Strengths and limitations of this study

- This review is a comprehensive amalgamation of current research investigating perceptions of generic medicines among physicians, pharmacists and lay people.
- Our review used widely accepted methodology to evaluate the literature, and identified that a significant proportion of medical professionals and lay people hold negative perceptions of generic medicines.
- The review may have increased the risk of publication bias by only including studies that were published and available through the four databases we accessed, and hand searching was not performed.
- While there are a range of studies looking at attitudes of the general population and of doctors towards generics, there were only nine studies examining those views of pharmacists, which may have reduced the accuracy of the estimates in this group.

INTRODUCTION

Generic medicines have been available for many years and are routinely used to treat a wide range of acute and chronic illnesses. In order to be approved for use, a generic medicine must be bioequivalent to the originator product, and must be the same in terms of strength, safety and quality.¹ While generic medicines are permitted to differ from their equivalent branded medicine in terms of colour, size, shape and excipient ingredients, they must be able to demonstrate bioequivalence to the originator product in terms of the rate and extent of absorption.^{2 3} Generic formulations provide the same therapeutic effect as branded medicines at a much more economical price.⁴ For this reason, generic drugs have been increasingly popular as a method to reduce pressure on drug budgets, and they now make up an increasing percentage of dispensed drugs.⁵

Although generic medicine use has become more widespread, there is evidence that many doctors and pharmacists hold negative views of generics and resist prescribing generic medicines.^{6 7} Many doctors oppose brand substitution, believing generic medicines to be inferior to their branded counterparts.⁷ In the UK, there was strong opposition when plans were proposed to introduce generic substitution into UK primary care,⁸ as well as controversy about using generic antiepileptic drugs⁹ and generic pregabalin for pain control.¹⁰

A number of surveys have also shown sizable proportions of patients reporting negative views about generics, believing them to be less effective, of lower quality and unsuitable for treatment of major illnesses, as compared to their branded equivalents.^{11–14} Such negative views of generic medicines are important because they are likely to be associated with poorer health outcomes due to an association with higher side effect reporting and lower adherence.^{14 15} If a substantial proportion of doctors, pharmacists and the general population hold negative views of generic drugs, it could represent an impediment to the widespread adoption of generic medication.

We conducted a systematic review to examine the attitudes towards generic drugs held by lay people, doctors and pharmacists. We extracted from the literature the proportion of participants who held negative views about how generics were perceived compared to their branded equivalent for the following five perceptions: drug effectiveness, drug quality, the likelihood of causing side effects, drug safety and attitude towards generic substitution or the process of replacing a branded medication with its generic equivalent.

METHODS

Inclusion criteria

To be eligible for inclusion in the review, studies had to include quantitative data presented as proportion of participants holding perceptions about generic medicines along any of the relevant dimensions. Studies could be either cross-sectional, mixed method or prospective in design. They also had to be in English, published in or after 1980, and had to include self-report measures to evaluate general perceptions about generic medicines, presented as percentages of the total sample assessed.

Data sources and searches

A systematic search of databases (MEDLINE, EMBASE, PsycINFO, Scopus) was conducted on 6 September 2015, to retrieve relevant peer reviewed articles. The search strategy (see online supplementary appendix 1) employed for this review drew on common phrases and terms used in the literature concerning generic medicines, and included input from a specialist librarian. Keywords (appropriately truncated to allow a wide search) were combined with medical subject headings (MeSH) to comprehensively search four databases. The strategy was modified for Scopus due to a different

search platform. Hand searching was not performed, but reference lists of identified systematic reviews and narrative reviews were reviewed to identify further studies.

Data collection

One author (SC) reviewed the titles and available abstracts for all identified citations, to determine relevance. Following the initial review, two of the authors (SC and MHS) independently reviewed full-text publications to make a final selection of included studies. A structured Excel spreadsheet was used to record relevant information and ensure uniformity of evaluation for each study. Extracted data included study characteristics including country of origin, sample type (doctor, pharmacist or lay population), sample size and proportions of participants with negative perceptions of generic medicines. The primary outcomes of this review were the proportions of participants reporting perceptions about generic medicines in terms of generic substitution, effectiveness, quality, side effects and safety.

Quality assessment

Two reviewers (KF and LRM) independently examined the full-text publications to complete a quality assessment. Raters independently categorised the articles as high, acceptable or poor quality, based on an evaluation of study design, participants (N, and type), demographics, recruitment method (random or other), exclusionary criteria, method of assessing perceptions (interview, questionnaire) and question quality (clarity, appropriate response options) (see online supplementary appendix 2). Consensus between the two reviewers was used to resolve any disagreement. Studies that were classified as being of poor quality were subsequently excluded. In line with Cochrane recommendations, we chose not to use a standardised scoring system to assess study quality. Calculating a summary score was not carried out so as to avoid assigning 'weights' to items on the scale that were unlikely to accurately reflect their relevance and that may have changed across different studies.¹⁶

Statistical analyses

From the full text of each paper, the total number of participants who took part in each study and the percentage who held perceptions of generic medicines across the five domains were extracted. These data were used to calculate the proportion of participants who reported negative views of generics compared to those who reported more accurate or positive views. These figures were summed to yield a total proportion of negative to neutral/positive views for each of the three population samples under investigation (general population, physician and pharmacist) for perceptions of effectiveness, quality, side effects, safety and substitution of generic medicines. Within each perception, the proportion of negative to neutral perceptions was compared across the three participant groups using χ^2 tests of

contingency tables with a Yates correction using GraphPad QuickCalcs software (<http://graphpad.com/quickcalcs/>). As this approach required multiple comparisons, a conservative Bonferroni correction with an adjusted α level of $p=0.0033$ ($0.05/15$ tests) was used.

For additional clarity and ease of interpretation in the presentation of the results, the extracted data were also used to calculate a weighted percentage (equivalent to the number of participants reporting negative views of generics out of the total number of respondents in each sample for each perception) of people holding negative perceptions across the relevant studies in each domain, assessed by generating a total sum of the number of participants with negative views, and calculating a percentage based on the total number of respondents in each group. Following this, modified Wald 95% CIs were calculated for each weighted percentage value.¹⁷ The weighted percentages and 95% CIs were calculated using Microsoft Excel 2010 software.

Finally, Spearman's correlations were utilised in order to assess whether there had been a systematic change in perceptions of generic medicines over time. Correlations between publication year and the percentage of participants reporting negative perceptions were conducted to assess relationships between (1) the percentage of participants holding negative perceptions (across all participants and all five domains) and publication year, (2) the percentage of negative perceptions in each domain (across all participants) and publication year and (3) the percentage of negative perceptions across all domains within each of the three participant groups. Spearman's correlations were used because publication year was not normally distributed (almost 80% of the papers were published in the past 10 years), and were carried out using SPSS V.22 software. As this approach required multiple comparisons, a conservative Bonferroni correction with an adjusted α level of $p=0.0055$ ($0.05/9$ tests) was used.

RESULTS

Search results

The systematic search process identified 2737 potentially relevant publications. The initial review eliminated 2582 of these publications, including duplicates, leaving 155 articles for full-text review. Of these, 73 articles were put forward for quality assessment. During this process, 21 studies were eliminated (figure 1). The publication dates for these studies ranged from 1987 through 2015, and included data from 27 countries. Additional characteristics of the studies included in the review are presented in table 1 for the general population, and in table 2 for doctors and pharmacists.

Study quality

The two raters initially made identical assessments in 48 of the 58 eligible papers, yielding a Cohen's κ inter-rater reliability of 0.70, $p<0.001$, which indicates substantial agreement.¹⁸ Subsequently, each of the 10 cases on

which raters disagreed was re-evaluated. For these studies, one rater had indicated acceptable and the other, either high or poor quality, but in no case was there a high-poor pairing. Discussion of rationale for the non-identical ratings was completed, and the raters came to a final agreement on each of the 10 cases. Of 58 studies, 29 were classified as high-quality, 23 were classified as acceptable and 6 were rated as being of poor quality. The six studies rated as poor quality were removed from the analysis.

PERCEPTIONS OF GENERIC MEDICINES

Effectiveness

A significantly greater proportion of the general population held the view that generic drugs were less effective than their brand name equivalents (5274/14 817; 35.59% (95% CI (34.83% to 36.37%)), compared to doctors (1450/5056; 28.68% (95% CI (27.45% to 29.94%))), χ^2 (1)=80.22, $p<0.0001$) and pharmacists (264/1119; 23.60% (95% CI (21.20% to 26.18%))), χ^2 (1)=65.57, $p<0.0001$). The proportion of physicians who held these negative views was significantly greater than pharmacists, χ^2 (1)=11.57, $p=0.0007$ (see figure 2 for graphical representation of results).

Quality

At least 25% from each group reported the belief that the quality of generic medications is lower than that of branded drugs. Pharmacists reported the highest

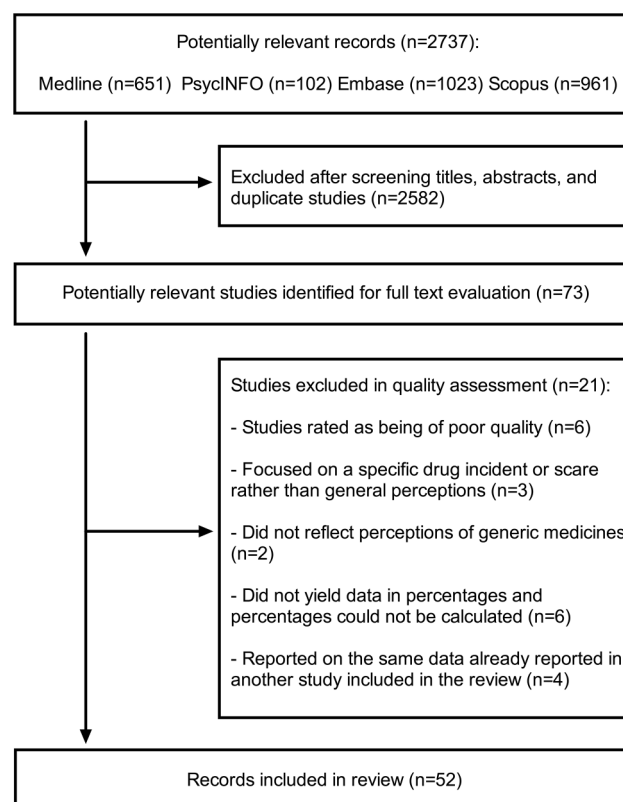


Figure 1 Flow chart of studies assessing perceptions of generics.

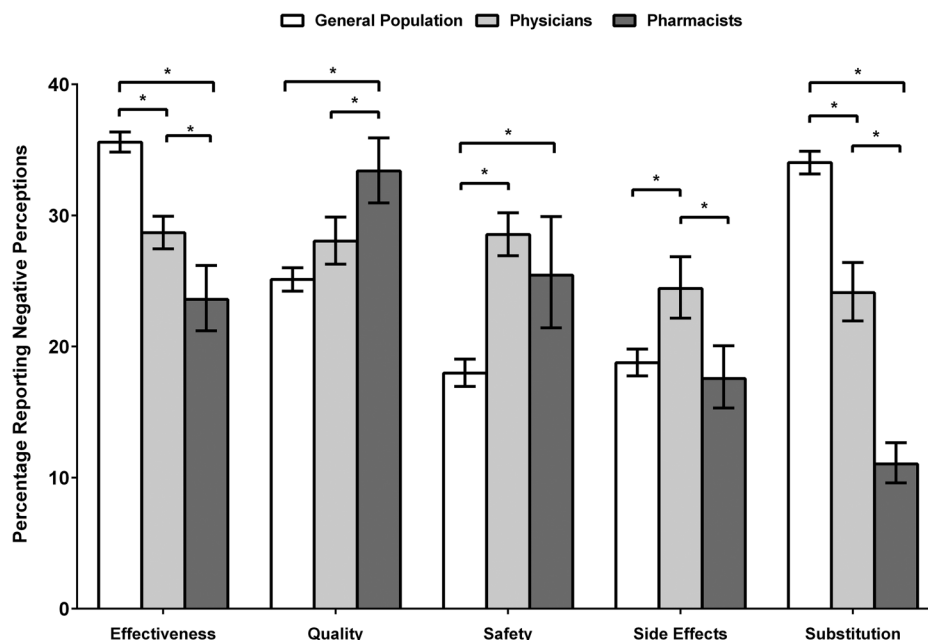
Table 1 Selected studies assessing layperson perceptions of generic medicines

Authors, date	Country	Sample	N	Substitution, %	Effectiveness, %	Quality, %	Side effects, %	Safety
Al-Gedadi <i>et al</i> , 2008 ²¹	Malaysia	Lay	396		38.80	38.90	31.20	
Babar <i>et al</i> , 2011 ⁵	New Zealand	Lay	441		22.90		34.20	
Bertoldi <i>et al</i> , 2005 ²³	Brazil	Lay	3182			30		
Bradley <i>et al</i> , 1998 ²⁴	UK	Lay	2276	43.90				
Costa-Font <i>et al</i> , 2014 ²⁵	Spain	Lay	2244	13.20				
Dunne <i>et al</i> , 2014 ²⁶	Ireland	Lay	42		18	24		5
Figueiras <i>et al</i> , 2009 ²⁷	Portugal	Lay	819	40				
Heikkilä <i>et al</i> , 2011 ²⁸	Finland	Lay	1844		19.10			15.50
Himmel <i>et al</i> , 2005 ¹³	Germany	Lay	804			36.70		
Ibrahim <i>et al</i> , 2012 ²⁹	Australia	Lay	503		13	13	5	15
Iosifescu <i>et al</i> , 2008 ³⁰	USA	Lay	315		15.60		11.60	20.10
Keenum <i>et al</i> , 2012 ³¹	USA	Lay	172		23.30		13.40	
Kobayashi <i>et al</i> , 2011 ³²	Japan	Lay	1215	46				
Kohli and Buller, 2013 ³³	USA	Lay	160		17	28		9
Lebanova <i>et al</i> , 2012 ³⁴	Bulgaria	Lay	216		94	94		94
Lira <i>et al</i> , 2014 ³⁵	Brazil	Lay	278		20.9	14.4		
Nardi <i>et al</i> , 2015 ³⁶	Brazil	Lay	5000		30.4			
Omojasola <i>et al</i> , 2012 ³⁷	USA	Lay	525		6	7	29.60	3
Palagyi and Lassanova, 2008 ³⁸	Slovakia	Lay	1777		64	16.70		
Perri <i>et al</i> , 1990 ³⁹	USA	Lay	326		13.50	11.40		6.70
Piette <i>et al</i> , 2010 ⁴⁰	USA	Lay	806		31.60			28.50
Rathe <i>et al</i> , 2013 ⁴¹	Denmark	Lay	2476	14.50				
Sansgiry and Bhosle, 2004 ⁴²	USA	Lay	505		10.92	7.40	5.08	6.08
Shrank <i>et al</i> , 2009 ⁴³	USA	Lay	1047	26.10			9.50	
Sicras-Mainar and Navarro-Artieda, 2012 ⁴⁴	Spain	Lay (and physician)	203			33.20	42.30	
Wong <i>et al</i> , 2014 ⁴⁵	Malaysia	Lay	202		23.8	23.3	23.8	
Yousefi <i>et al</i> , 2015 ⁴⁶	Iran	Lay	1309	81	86		21.4	
N reporting negative perceptions				3874	5274	2290	1054	942
Total N sampled				11 386	14 817	9119	5618	5242
Overall percentage				34.03	35.59	25.11	18.76	17.97

Table 2 Selected studies assessing physician and pharmacist perceptions of generic medicines

Authors, date	Country	Sample	N	Substitution, %	Effectiveness, %	Quality, %	Side effects, %	Safety, %
Andersson <i>et al</i> , 2006 ⁴⁷	Sweden	Physicians	892	16.70				
Bower and Burkett, 1987 ⁴⁸	USA	Physicians	317	37.50				
Brust <i>et al</i> , 1990 ⁴⁹	USA	Physicians	145	45				
Chua <i>et al</i> , 2010 ⁵⁰	Malaysia	Physicians	87		33		41.40	52.90
Dosedel <i>et al</i> , 2014 ⁵¹	Czech Republic	Physicians	263		39.1	46	37.3	
Dunne <i>et al</i> , 2014 ⁵²	Ireland	Physicians	34		11.8	8.8		11.8
Fabiano <i>et al</i> , 2012 ⁵³	Italy	Physicians	303		17.50		17.80	
Friedman <i>et al</i> , 1987 ⁵⁴	USA	Physicians	245		43.20			
Gossell-Williams, 2007 ⁵⁵	Jamaica	Physicians	60	13	60			
Jamshed <i>et al</i> , 2012 ⁵⁶	Pakistan	Physicians	206		24.30	39.30	26.70	41.26
Kersnik and Peklar, 2006 ⁵⁷	Slovenia	Physicians	117		11.10			
Kumar <i>et al</i> , 2015 ⁵⁸	Malaysia	Physicians	263		51.7		19.8	
Lewek <i>et al</i> , 2014 ⁵⁹	Poland	Physicians	170		28.8		12.1	
Shrank <i>et al</i> , 2011 ⁷	USA	Physicians	506		23.50	50		
Sicras-Mainar and Navarro-Artieda, 2012 ⁴⁴	Spain	Physician (and lay)	201		40.80			
Theodorou <i>et al</i> , 2009 ⁶⁰	Greece	Physicians	1204		14.09	16.83		15.37
	Cyprus		193		5.70	7.25		5.70
Tsiantou <i>et al</i> , 2009 ⁶¹	Greece	Physicians	1204		40.70			41.90
N reporting negative perceptions				341	1450	675	316	836
Total N sampled				1414	5056	2406	1292	2928
Overall percentage				24.11	28.68	28.04	24.43	28.54
Allenet and Barry, 2003 ⁶²	France	Pharmacists	1000	10				
Auta <i>et al</i> , 2014 ⁶³	Nigeria	Pharmacists	154	7.10		54.50		
Awaisu <i>et al</i> , 2014 ⁶⁴	Qatar	Pharmacists	108	27.70				
Babar <i>et al</i> , 2011 ⁵	New Zealand	Pharmacists	360	10.60	50	65		28
Chong <i>et al</i> , 2010 ⁶⁵	Australia	Pharmacists	157				13.40	
Chong <i>et al</i> , 2011 ⁶	Malaysia	Pharmacists	219			21.40	38.40	
Dunne <i>et al</i> , 2014 ⁶⁶	Ireland	Pharmacists	44		2.3	2.3		4.5
Gupta, 1996 ⁶⁷	USA	Pharmacists	100		40			
Maly <i>et al</i> , 2013 ⁶⁸	Czech Rep	Pharmacists	615		7	16.10	11.20	
N reporting negative perceptions				179	264	465	174	103
Total N sampled				1622	1119	1392	991	404
Overall percentage				11.04	23.60	33.39	17.56	25.44

Figure 2 Bar graph showing the percentage (95% CI) of participants (general population, physicians and pharmacists) reporting negative perceptions across the domains of effectiveness, quality, safety, side effects and substitution.



proportion of negative perceptions about quality (465/1392; 33.39% (95% CI (30.96% to 35.91%)), a significantly greater proportion of negative perceptions than in either the physician sample (625/2406; 26.04% (95% CI (26.28% to 29.87%)), χ^2 (1)=11.76, $p=0.0006$) or the general population (2290/9119; 25.11% (95% CI (24.23% to 26.01%)), χ^2 (1)=42.51, $p<0.0001$). Physicians and general population participants did not differ significantly from one another (after applying the Bonferroni correction), χ^2 (1)=8.47, $p=0.0036$.

Safety

A greater proportion of doctors (836/2928, 28.54%, 95% CI (26.93% to 30.20%)) and pharmacists (103/404; 25.44%, 95% CI (21.43% to 29.91%)) held the perception that generic medicines were less safe to use than branded drugs than did the general population (942/5242; 17.97%, 95% CI (16.96% to 19.04%)), χ^2 (1)=122.93 and 13.59, respectively, $p<0.0001$ and 0.0002. Physicians and pharmacists did not differ from one another with regard to negative perceptions of safety of generic drugs, χ^2 (1)=1.49, $p=0.22$.

Side effects

Physicians were the most likely to hold negative beliefs that side effects are more frequently caused by generic drugs in comparison to brand name alternatives, with one in four (316/1292; 24.43%, 95% CI (22.17% to 26.85%)) endorsing these views. Physicians held significantly more inaccurate beliefs about side effects than did the general population groups (1054/5618; 18.76%, 95% CI (17.76% to 19.80%)), χ^2 (1)=21.09, $p<0.0001$, and pharmacists (174/991; 17.56% (95% CI (15.31% to 20.06%)), χ^2 (1)=15.43, $p<0.0001$. There was no significant difference between the proportions of members of the general population and pharmacists reporting the

perception that the side effects of generic drugs are higher than branded, χ^2 (1)=0.73, $p=0.3934$.

Drug substitution

Pharmacists had the lowest rates of negative perceptions about substitution of generic drugs for their brand name alternatives (179/1622; 11.04%, 95% CI (9.60% to 12.66%)). The general population were most likely to report unfavourable attitudes towards substituting a branded medication with its generic equivalent (3874/11386; 34.03%, 95% CI (33.16% to 34.90%)), followed by physicians (341/1414; 24.11%, 95% CI (21.95% to 26.41%)). Pharmacists had significantly lower rates of negative perceptions about generic drug substitution than both, members of the general population and doctors, χ^2 (1)=348.72 and 90.14, respectively, $p<0.0001$. The general population samples held more negative perceptions of drug substitution than did physicians, χ^2 (1)=55.46, $p<0.0001$.

Perceptions of generic medicines over time

There was no significant overall relationship between publication year and the percentage of participants reporting negative perceptions of generic medicines across all participant groups and perception domains, $r=-0.04$, $n=115$, $p=0.641$. Similarly, the percentage of negative perceptions held across the five domains did not demonstrate a significant correlation with publication year for beliefs about effectiveness, $r=-0.03$, $n=37$, $p=0.853$; quality, $r=-0.02$, $n=25$, $p=0.919$; safety, $r=-0.20$, $n=18$, $p=0.424$; side effects, $r=0.08$, $n=20$, $p=0.742$; or appropriateness of substitution, $r=-0.11$, $n=15$, $p=0.693$. Finally, the change in the percentage of negative perceptions over time was assessed separately across the three participant groups. There was no significant correlation between negative perceptions and publication year for

general population samples, $r=0.10$, $n=60$, $p=0.431$; or physicians, $r=-0.04$, $n=37$, $p=0.794$. There was a trend (after applying the Bonferroni correction) towards a significant correlation in pharmacists' overall negative perceptions and publication year, $r=-0.50$, $n=18$, $p=0.034$. Although the result is not statistically significant, it indicates a possible reduction in overall reported negative perceptions in pharmacists over time.

DISCUSSION

Key findings

Our systematic review identified that a significant proportion of lay people, doctors and pharmacists hold negative perceptions of generic medicines, perceiving generics as less effective, less safe, inferior in quality and more likely to cause side effects compared to their branded equivalents. More than a quarter of doctors and the general population believed that generic drugs are less effective and of poorer quality than branded medication. A similar proportion of doctors and pharmacists had safety concerns about generics. While we did not identify any reduction in negative views of generics in doctors or lay people over the course of the review period, there was some evidence that the percentage of negative views of pharmacists had decreased.

These findings are important, as previous work has suggested that negative perceptions about generic medicines are major barriers to their acceptance and widespread usage.² Furthermore, these findings have important implications for clinical practice, as pharmacists and medical practitioners are in a position where they can easily transmit their expectations about the effectiveness and side effects of generic medication to the patients under their care.^{19 20} Research suggests that the majority of consumers learn about generic medicines from a physician or pharmacist, and this medical advice is critical to consumers' decision to take a generic medication.^{11 21}

Implications

Generic medicines provide cost-effective alternatives to branded medicines, resulting in considerable savings to healthcare budgets. However, if consumers are poorly informed about their equivalence to branded medication, it is highly unlikely that generic medicines will be preferred over their branded equivalents.²² This review has identified that a significant proportion of health professionals and consumers have negative perceptions of generic medicines. There is clearly a need for interventions aimed at the general population and health professionals to target misperceptions of inferior quality, safety and efficacy—as well as to explain the reasons why generic medicines are cheaper than brand-name equivalents, the meaning of bioequivalence, and the testing and regulatory processes involved in approving a generic medicine for general use.² Currently, there is a lack of

research regarding what type of intervention may be effective in improving perceptions of generic medicines.

Strengths and limitations

This review is a comprehensive amalgamation of current research investigating perceptions of generic medicines among physicians, pharmacists and laypeople. The methods used to search and evaluate the literature are widely accepted. However, it is important to note that we may have increased the risk of publication bias by only including studies that were published and available through one of the four databases we accessed, and hand searching was not performed. In addition, we only reviewed studies that were published in English and we did not include qualitative studies, as we needed to compute the proportion of participant between physicians, pharmacists and lay groups. While there are a range of studies looking at the attitudes of the general population and doctors towards generics, there were only nine studies examining the views of pharmacists, and five of these studies had fewer than 200 participants. This may have reduced the accuracy of the estimates in this group.

CONCLUSIONS

These results suggest that there are a significant number of laypeople, doctors and pharmacists with concerns about the efficacy, safety and quality of generic medicines. The negative perceptions of doctors and pharmacists are likely to be barriers to a wider acceptance of generics, as health professionals have a strong influence on patients' decisions to take generic medicine. Further work is needed on how interventions for medical professionals and for the public can reduce negative attitudes about efficacy, safety and side effects, in order to increase the acceptability of generic prescribing and substitution.

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Contributors SC and KJP designed the study. SC and MHS searched the literature and extracted the data. KF and LRM conducted the quality analysis, and analysed and interpreted the data. SC, KF and KJP drafted the manuscript. AG, MHS and LRM contributed to the critical revision of the manuscript. SC and KJP are the guarantors.

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