SYSTEMATIC REVIEWS

METHODOLOGY Open Access

Impact of contacting study authors to obtain additional data for systematic reviews: diagnostic accuracy studies for hepatic fibrosis

Shelley S Selph[1*], Alexander D Ginsburg[1] and Roger Chou[1,2]

Abstract

Background: Seventeen of 172 included studies in a recent systematic review of blood tests for hepatic fibrosis or cirrhosis reported diagnostic accuracy results discordant from 2 × 2 tables, and 60 studies reported inadequate data to construct 2 × 2 tables. This study explores the yield of contacting authors of diagnostic accuracy studies and impact on the systematic review findings.

Methods: Sixty-six corresponding authors were sent letters requesting additional information or clarification of data from 77 studies. Data received from the authors were synthesized with data included in the previous review, and diagnostic accuracy sensitivities, specificities, and positive and likelihood ratios were recalculated.

Results: Of the 66 authors, 68% were successfully contacted and 42% provided additional data for 29 out of 77 studies (38%). All authors who provided data at all did so by the third emailed request (ten authors provided data after one request). Authors of more recent studies were more likely to be located and provide data compared to authors of older studies. The effects of requests for additional data on the conclusions regarding the utility of blood tests to identify patients with clinically significant fibrosis or cirrhosis were generally small for ten out of 12 tests. Additional data resulted in reclassification (using median likelihood ratio estimates) from less useful to moderately useful or vice versa for the remaining two blood tests and enabled the calculation of an estimate for a third blood test for which previously the data had been insufficient to do so. We did not identify a clear pattern for the directional impact of additional data on estimates of diagnostic accuracy.

Conclusions: We successfully contacted and received results from 42% of authors who provided data for 38% of included studies. Contacting authors of studies evaluating the diagnostic accuracy of serum biomarkers for hepatic fibrosis and cirrhosis in hepatitis C patients impacted conclusions regarding diagnostic utility for two blood tests and enabled the calculation of an estimate for a third blood test. Despite relatively extensive efforts, we were unable to obtain data to resolve discrepancies or complete 2 × 2 tables for 62% of studies.

Keywords: Contacting study authors, Diagnosing hepatic fibrosis, Hepatitis C infection, Systematic review

Background

Systematic reviewers often identify studies containing discordant, inconsistent, or missing data. Studies with such deficiencies can potentially influence the outcome of quantitative and qualitative synthesis of results. As a result, determining the best strategy to address incomplete, inaccurate, or missing data is a major methodological challenge in conducting systematic reviews.

The problem of missing data in systematic reviews appears to be common. A 2006 meta-analysis of weight loss interventions found that 40% of 604 studies had missing or incomplete data on important variables such as age and sample size [1]. Similarly, a 2004 review of the effects of aerobic exercise on lipids and lipoproteins found that 22% of 174 studies had missing data [2].

One suggested strategy for addressing this issue is for systematic reviewers to contact study authors to clarify

* Correspondence: selphs@ohsu.edu
[1]The Pacific Northwest Evidence-based Practice Center, Department of Medical Informatics and Clinical Epidemiology, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, Mail Code: BICC, Portland, OR 97239, USA
Full list of author information is available at the end of the article

discordant data or to obtain missing data [3,4]. However, there is little known about the yield of requests for data or the effects of data obtained through author contact on the findings of systematic reviews. A 2009 review found that 50% of 93 systematic reviews in the 25 medical journals with the highest impact factors and 85% of 54 Cochrane systematic reviews published between 2005 and 2006 report contacting authors [5]. Further, 43% of reviews in the top medical journals and 83% of Cochrane reviews describe the process of author contact. However, only 4% of journal reviews and 9% of Cochrane reviews reported the response rates to author contacts. Evidence regarding the yield and impact of author requests is particularly sparse in the area of diagnostic tests.

In 2012, the Pacific Northwest Evidence-based Practice Center conducted a systematic review to determine the diagnostic accuracy of various blood tests for hepatic fibrosis or cirrhosis in patients with chronic hepatitis C viral infection [6-8]. We found evidence that a number of blood tests are useful for identifying clinically significant fibrosis or cirrhosis, based on positive likelihood ratios of 5 to 10, suggesting a potential role as an alternative to liver biopsy. However, of the 172 included studies, 17 studies reported data that were discordant from 2×2 tables (i.e., number of true positives, false positives, true negatives, and false negatives) calculated from the information provided (e.g., prevalence of fibrosis or cirrhosis, sensitivity, and specificity) in the studies. In addition, 60 studies were missing necessary data for one or more diagnostic tests to be included in summary estimates. To the authors' knowledge, this is the first study to evaluate the responsiveness of authors contacted to clarify discordant data or obtain missing data and the impact of the additional data provided in studies of diagnostic accuracy.

Methods

Included studies

Based on the previous systematic review [6-8], we identified 17 studies [9-25] that had discrepancies in the data reported and 60 studies [26-86] that provided insufficient data to construct 2×2 tables at standard cutoffs for one or more diagnostic tests. We defined studies with discrepancies as those in which reported measures of diagnostic accuracy were inconsistent with measures of diagnostic accuracy calculated from 2×2 tables by values of >0.10 (e.g., reported a positive predictive value of 0.85 vs. calculated a positive predictive value of 0.70). For studies in which 2×2 table data were not provided, we calculated values for 2×2 tables for commonly reported cutoff values for a positive test, based on the reported sample size, prevalence of the condition of interest (fibrosis or cirrhosis), sensitivity, and specificity. Studies for which we could not construct 2×2 tables included those in which some measures of diagnostic accuracy were reported, but other necessary information was missing (e.g., sample size, prevalence of condition); studies in which sensitivity and specificity were reported at non-standard cutoffs; and studies in which an area under the receiver operating characteristic (AUROC) was reported without sensitivity or specificity at standard cutoffs.

Contacting authors

We requested data from 66 corresponding authors from around the world (Table 1) for 77 studies. All publications were in English and all corresponding authors were contacted in English. We sent corresponding authors an initial request for additional data by email. For the convenience of authors, we provided labeled 2×2 tables they could fill in and send back to us. If there was no response to our initial email, after a minimum of three business days, we sent a second reminder email to the corresponding author. If there was still no response after a minimum of eight business days following the initial email, we sent a second reminder email. After a minimum of ten business days with no response, we then attempted to contact authors by telephone. If still unable to reach corresponding authors, we attempted to contact

Table 1 Number of authors contacted and provided data by country

Country	Authors contacted	Provided data
Austria	1	0
Belgium	2	1
Brazil	3	1
Egypt	7	2
France	12	5
Germany	2	1
Israel	2	1
Italy	6	3
Japan	2	1
Korea	2	2
Luxembourg	1	1
Mexico	1	0
The Netherlands	1	1
Pakistan	1	0
Romania	4	3
Spain	1	0
Sweden	1	0
Taiwan	2	1
Tunisia	1	0
Turkey	2	1
United Kingdom	5	0
United States	7	4
Total	66	28

the last authors and statisticians, if identifiable. If corresponding authors forwarded our request to other authors, we sent reminders to these authors. After a minimum of 15 business days from our initial email, we sent a final email to authors. If we received an automated "out-of-office" response, we waited until the author had returned to send further reminders.

Incorporation of data

For studies with discrepancies and cases in which we could not construct a 2×2 table, we requested that authors provide the 2×2 data used to generate their estimates of diagnostic accuracy. For studies that provided only AUROC or did not report diagnostic accuracy at standard cutoffs, we asked that authors provide 2×2 data for diagnostic accuracy at standard cutoffs for the blood test or tests evaluated.

We recalculated median values and ranges for sensitivity and specificity at the cutoffs used in the original review using additional data obtained, and we compared differences between the updated and original findings. We categorized blood tests reporting a positive likelihood ratio of

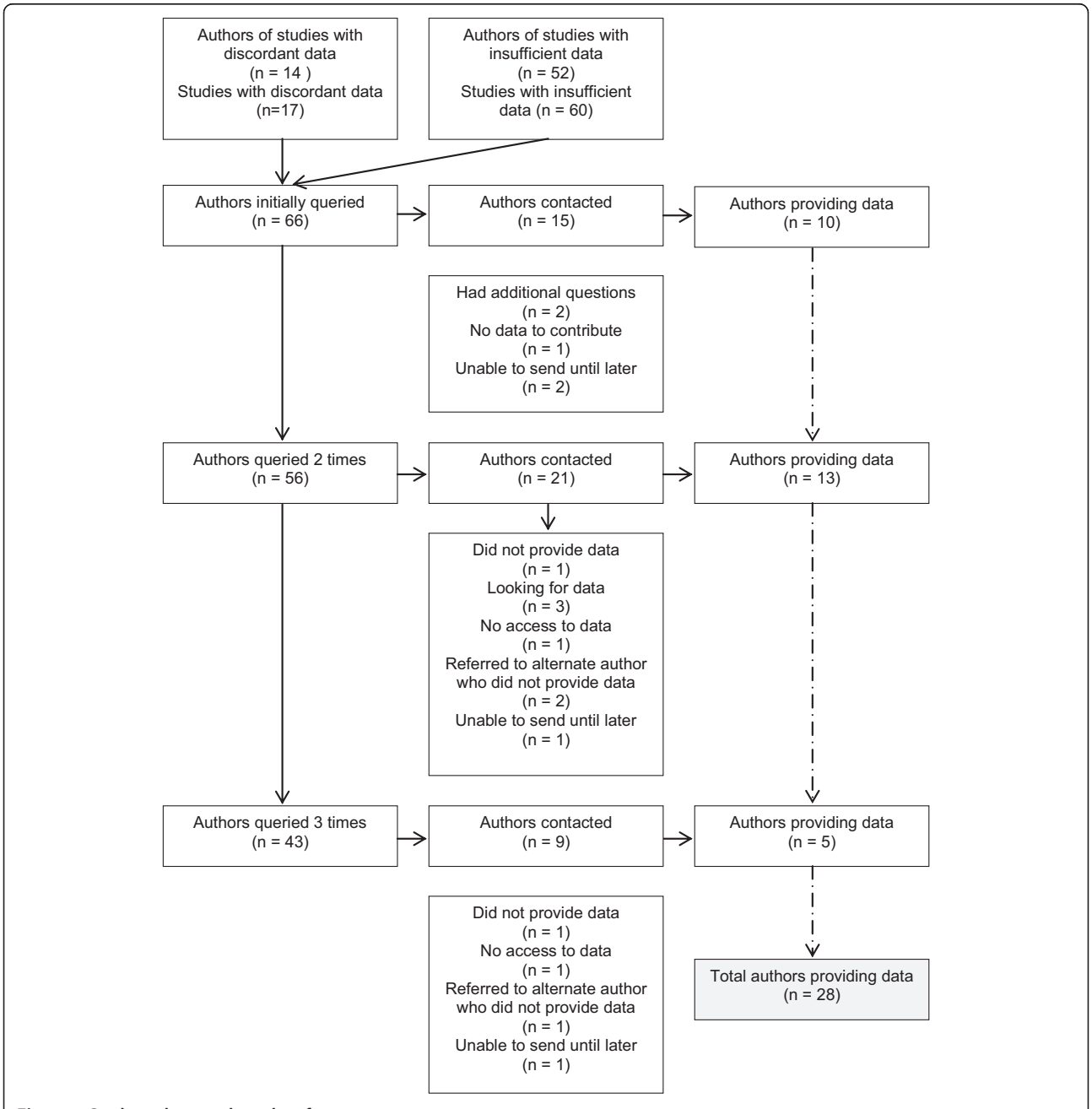

Figure 1 Study authors and results of contact attempts.

5 to 10 or a negative likelihood ratio of 0.1 to 0.2 as moderately useful (no blood test was associated with a positive likelihood ratio of >10 or negative likelihood ratio <0.1) [87]. We also reassessed the strength of evidence with the additional data.

We compared the recalculated sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio to the pooled estimates from the initial review. In addition, we compared the new strength of evidence ratings to that based on the dataset from the initial review.

Results

Response rate

Of the 66 authors, we were able to contact 45 (68%) (Figure 1). Of those 45 authors, 28 provided additional data for 29 studies, including four who provided datasets. Among authors whom we were able to contact, reasons for not sending data included the following: no current access to the data and need for additional time to find and format the data (e.g., data stored on a floppy disk).

All authors who provided data did so by the third request for information (second reminder). We received information from ten authors after only one request. Two requests were required for 13 authors, and three were required for five authors. The average number of total days between the initial request and the first reminder was seven, between the first reminder and the second was 13, and between the second reminder and the third was 16. The minimum and maximum number of days between any two contact attempts was three and 34, respectively. Several authors were on holiday or sabbatical, and we waited until their return to continue sending reminders which resulted in longer times between requests. We received no additional information after three requests and received no additional data in response to telephone contact.

There was no difference in the likelihood of providing data between authors of studies with discrepancies compared with authors of studies in which 2×2 tables could not be calculated (54% vs. 40%, $p = 0.36$). Of the 17 studies in which there was a discrepancy between reported results for diagnostic accuracy and constructed 2×2 tables, seven of 13 authors provided data on seven studies [9,12,13,16,18,20,25], including one dataset [18]. We were unable to contact four authors [11,14,19,21], one author forwarded our request to a colleague who did not provide the data [22-24], one provided data for one of two studies [17], and one declined telephone contact [15]. Of the 60 studies missing information to generate 2×2 tables, 21 of 53 authors provided additional or confirmatory data on 22 studies [28,30-35,39,49,51,52,57,62,66,68,69,71,77,78,81,85,86], including three datasets [49,77,78]. Reasons for not providing data were similar to those for authors of studies with discrepancies. Authors of more recent studies were more likely to be located and provide data ($p = 0.02$). The mean year of publication of studies for which we received additional data was 2010. The mean year of publication of studies by contacted authors who did not provide additional data was 2008, while the average publication year for authors of studies we could not locate was 2007. Country of publication did not appear to predict the likelihood of receiving data (Table 1).

Effect on diagnostic accuracy

For diagnosing hepatic fibrosis, additional data were provided for 12 out of 16 blood tests. The number of additional studies for specific tests and cutoffs ranged from zero to nine (zero additional studies occurred when additional data were obtained, but only for studies with discrepancies, so that one set of data was replaced by another) (Tables 2 and 3) There was little impact on median estimates of diagnostic accuracy for the two tests with the greatest number of additional studies added (five and ten studies). See the full report for specific tests affected [88].

Additional data for two tests for fibrosis resulted in a meaningful change in test usefulness from less useful to moderately useful for one test and from moderately useful to less useful for one test. Although the additional data resulted in the reclassification of two additional blood tests, the actual change in median estimates was small to minimal. Additional data also enabled us to create estimates of diagnostic accuracy for fibrosis for one test, for which data had previously been insufficient to do so.

For diagnosing cirrhosis, additional data were provided for eight of 16 blood tests. For the test with the greatest number of additional studies (ten studies), the effect on median likelihood ratio estimates was minimal [88]. The number of additional studies ranged from one to five for other blood tests. Additional data for two tests enabled reclassification from less useful to moderately useful, but the impact on the actual estimates was minimal.

We compared the effects of additional data from studies with discrepancies with the effects of additional data from studies in which 2×2 tables could not be generated and found no clear pattern suggesting differential effects on median estimates. We also evaluated effects of additional data with respect to the original strength of evidence ratings. The overall strength of evidence rating did not change for any of the tests for which we obtained additional data. The test for which we received the most additional data was already rated high strength of evidence.

Discussion

Our experience demonstrates that obtaining additional data through author contacts for studies of diagnostic

Table 2 Diagnostic accuracy of tests for fibrosis

Fibrosis test (cutoff)	Number of samples	Sensitivity (median, range)	Specificity (median, range)	Positive likelihood ratio (median, range)	Negative likelihood ratio (median, range)
Platelets <140 to <163	8	0.56 (0.28–0.89)	0.91 (0.69–1.0)	6.3 (2.3–14)	0.48 (0.16–0.78)
With additional data	10[a]	0.57 (0.28–0.89)	0.91 (0.58–1.0)	6.3 (1.64–35)	0.48 (0.16–0.78)
API >3.5 or ≥4.0	5	0.70 (0.52–0.82)	0.70 (0.51–0.77)	2.3 (1.7–2.7)	0.43 (0.34–0.67)
With additional data	6[a]	0.64 (0.52–0.82)	0.69 (0.51–0.77)	2.0 (1.7–2.7)	0.53 (0.34–0.67)
API ≥6.0	5/3[b]	0.51 (0.19–0.75)	0.90 (0.58–0.96)	*5.1 (1.8–7.3)*	0.54 (0.43–0.94)
With additional data	6[a]	0.54 (0.19–0.75)	0.88 (0.58–0.96)	*4.5 (1.4–7.3)*	0.52 (0.43–0.94)
APRI ≥0.5 to >0.55	28	0.81 (0.29–0.98)	0.55 (0.10–0.94)	1.8 (1.1–4.8)	0.35 (0.08–0.78)
With additional data	40[c]	0.79 (0.29–0.98)	0.56 (0.10–1.0)	1.8 (1.0–7.5)	0.56 (0.07–0.93)
AST: ALT ratio >1.0	5	0.35 (0.08–0.45)	0.77 (0.62–1.0)	1.5 (1.1–15)	0.84 (0.84–0.98)
With additional data	8[a,c]	0.36 (0.08–0.59)	0.80 (0.48–1.0)	1.7 (1.1–14)	0.81 (0.65–0.98)
ELF >8.75, >9.0, or >9.78	3	0.85 (0.84–0.86)	0.70 (0.62–0.80)	2.8 (2.3–4.2)	0.21 (0.19–0.23)
With additional data	3[a]	0.84 (0.62–0.85)	0.80 (0.70–0.86)	4.2 (2.8–4.4)	0.20 (0.19–0.45)
FIB-4 > 1.26 or ≥1.45	6	0.64 (0.62–0.86)	0.68 (0.54–0.75)	2.0 (0.88–2.6)	0.53 (0.21–1.3)
With additional data	9[c]	0.64 (0.57–0.86)	0.68 (0.28–0.85)	2.0 (0.88–3.7)	0.53 (0.21–1.3)
FIB-4 > 3.25	4	0.50 (0.28–0.86)	0.79 (0.59–0.99)	*2.4 (1.3–28)*	0.63 (0.21–0.80)
With additional data	7[c]	0.28 (0.11–0.86)	0.97 (0.59–1.0)	*9.3 (1.3–28)*	0.74 (0.21–0.89)
FibroIndex >1.25	3	0.94 (0.62–0.97)	0.40 (0.40–0.48)	1.6 (1.2–1.6)	*0.15 (0.08–0.79)*
With additional data	6[c]	0.64 (0.54–0.97)	0.57 (0.40–1.0)	1.5 (1.2–2.2)	*0.62 (0.08–0.79)*
FibroIndex >2.25 or ≥2.25	3	0.30 (0.17–0.36)	0.97 (0.97–1.0)	10,12,∞	0.72 (0.66–0.83)
With additional data	4[c]	0.24 (0.14–0.36)	0.99 (0.97–1.0)	10,12,∞	0.78 (0.66–0.87)
FibroMeter >0.419 to >0.59	3	0.69 (0.64–0.80)	0.81 (0.76–0.81)	3.6 (3.4–3.6)	0.38 (0.26–0.44)
With additional data	5[c]	0.80 (0.64–0.87)	0.76 (0.64–0.81)	3.3 (2.4–3.6)	0.26 (0.21–0.44)
FibroTest >0.10 to >0.22	6	0.92 (0.88–0.97)	0.38 (0.27–0.56)	1.5 (1.3–1.9)	*0.21 (0.11–0.28)*
With additional data	9[c]	0.92 (0.64–0.98)	0.46 (0.21–1.0)	1.7 (1.2–2.2)	*0.17 (0.11–0.39)*
FibroTest >0.70 or >0.80	5	0.22 (0.20–0.50)	0.96 (0.95–0.98)	5.5 (5.5–13)	0.81 (0.53–0.82)
With additional data	10[a,c]	0.38 (0.20–0.94)	0.95 (0.36–0.98)	7.6 (1.4–13)	0.65 (0.12–0.82)
Forns Index >4.2 to >4.57	14	0.88 (0.57–0.94)	0.52 (0.20–0.77)	1.8 (1.2–2.2)	0.22 (0.12–0.64)
With additional data	16[a,c]	0.89 (0.42–0.94)	0.51 (0.20–0.77)	1.8 (0.54–2.2)	0.23 (0.12–2.6)
Forns Index >6.9	10	0.36 (0.18–0.61)	0.94 (0.66–1.0)	6.5 (1.6–18)	0.68 (0.56–0.92)
With additional data	14[c]	0.40 (0.18–0.81)	0.95 (0.33–1.0)	7.4 (1.2–18)	0.63 (0.22–0.92)
Hepascore >0.46 to ≥0.55	5	0.66 (0.54–0.82)	0.79 (0.65–0.86)	3.1 (2.3–4.5)	0.43 (0.28–0.55)
With additional data	8[c]	0.65 (0.54–0.82)	0.80 (0.65–0.86)	3.2 (2.3–4.5)	0.44 (0.28–0.55)
Lok Index >0.17 or >0.20	0	NA	NA	NA	NA
With additional data	3[c]	0.58 (0.48–0.82)	0.80 (0.58–0.81)	2.9 (2.0–3.1)	0.53 (0.31–0.65)

Values in italics indicate a change to above or below a cutoff of 5.0 for positive likelihood ratio or 0.20 for negative likelihood ratio.
ALT serum alanine aminotransferase, *API* age platelet index, *APRI* aspartate aminotransferase to platelet ratio index, *AST* aspartate aminotransferase, *ELF* enhanced liver fibrosis, *NA* not available.
[a]Additional data for study(s) with discrepancy in reported data.
[b]The first number is the number of samples for sensitivity/the second number is the number of samples for specificity.
[c]Additional data for study(s) without 2 × 2 tables.

accuracy is possible, although challenging. We were able to contact the majority of authors (45 out of 66). Most contacted authors (28 out of 45) provided data, and several more indicated that they would have had the data been more readily accessible to them. Although the effects of the additional data on summary estimates were relatively small in most cases, the changes had important implications in assessing the clinical utility of two tests, in one case moving a blood test into the moderately useful range and in the other case moving it out of the moderately useful range. This suggests that while including previously unpublished data can result in clinically

Table 3 Diagnostic accuracy of tests for cirrhosis

Fibrosis test (cutoff)	Number of samples	Sensitivity (median, range)	Specificity (median, range)	Positive likelihood ratio (median, range)	Negative likelihood ratio (median, range)
Platelets <140 to <155	9	0.78 (0.41–0.93)	0.87 (0.84–0.94)	6.0 (2.8–93)	0.25 (0.07–0.63)
With additional data	10[a]	0.77 (0.41–0.93)	0.86 (0.57–0.99)	5.5 (1.6–93)	0.27 (0.07–0.63)
API ≥6.0	5/3[b]	0.67 (0.43–0.80)	0.87 (0.81–0.93)	5.2 (2.7–10)	0.38 (0.22–0.68)
With additional data	6[a]	0.64 (0.12–0.80)	0.88 (0.81–0.99)	5.3 (2.7–17)	0.41 (0.22–0.88)
APRI >1.0 or ≥1.0	19	0.77 (0.33–1.0)	0.75 (0.30–0.87)	3.1 (1.4–4.9)	0.31 (0–0.77)
With additional data	30/29[b,c]	0.75 (0.13–1.0)	0.77 (0.30–1.0)	3.2 (1.4–10.6)	0.33 (0–0.89)
AST: ALT ratio >1.0	17	0.36 (0.12–0.78)	0.92 (0.59–1.0)	*4.5 (1.0–31)*	0.70 (0.47–1.0)
With additional data	19[a]	0.39 (0.10–0.78)	0.93 (0.59–1.0)	*5.6 (1.0–31)*	0.66 (0.23–1.0)
FIB-4 > 1.45	1	0.90	0.58	2.1	0.17
With additional data	4[c]	0.89 (0.87–1.0)	0.58 (0.40–0.70)	2.1 (1.7–2.9)	0.19 (0.0–0.23)
FIB-4 > 3.25	1	0.55	0.92	6.9	0.49
With additional data	5[c]	0.49 (0.40–0.55)	0.93 (0.91–0.95)	6.4 (5.7–8.9)	0.60 (0.49–0.63)
FibroTest >0.56 or >0.66	2	0.85 and 0.82	0.74 and 0.77	3.3 and 36	0.20 and 0.23
With additional data	7[c]	0.83 (0.27–0.91)	0.74 (0.65–1.0)	3.6 (2.6–3.6)	0.23 (0.11–0.73)
FibroTest >0.73, >0.75, >0.862	7	0.56 (0.30–1.0)	0.81 (0.24–0.96)	2.9 (1.2–10)	0.54 (0.0–0.79)
With additional data	10[a,c]	0.49 (0.11–0.86)	0.89 (0.55–1.0)	4.3 (1.2–11)	0.57 (0.20–0.89)
Forns Index >4.2	1	0.98	0.27	1.3	0.07
With additional data	6[c]	0.66 (0.27–1.0)	0.31 (0–1.0)	1.4 (0.27–1.5)	0.07 (0–0.66)
Forns Index >6.9	1	0.67	0.91	7.4	0.36
With additional data	3[c]	0.66 (0.53–0.67)	0.87 (0.86–0.91)	5.2 (4.2–7.4)	0.39 (0.36–0.53)
Lok Index ≥0.20 or >0.26	6	0.90 (0.67–1.0)	0.50 (0.30–0.82)	1.8 (1.0–4.8)	*0.21 (0–0.94)*
With additional data	7[c]	0.90 (0.67–1.0)	0.53 (0.30–0.82)	1.9 (1.0–4.8)	*0.19 (0–0.94)*
Lok Index ≥0.5 or >0.6	7	0.53 (0.40–0.79)	0.88 (0.60–0.95)	*4.4 (1.3–11)*	0.53 (0.24–0.80)
With additional data	8[c]	0.53 (0.23–0.79)	0.91 (0.60–0.97)	*5.8 (1.3–11)*	0.52 (0.24–0.80)

Values in italics indicate a change to above or below a cutoff of 5.0 for positive likelihood ratio or 0.20 for negative likelihood ratio.
ALT serum alanine aminotransferase, *API* age platelet index, *APRI* aspartate aminotransferase to platelet ratio index, *AST* aspartate aminotransferase.
[a]Additional data for study(s) with discrepancy in reported data.
[b]The first number is the number of samples for sensitivity/the second number is the number of samples for specificity.
[c]Additional data for study(s) without 2 × 2 tables.

important changes in estimates, the magnitude and direction of impact may not be readily predictable.

Although we successfully contacted 68% of authors, this effort was time consuming, not only for us but also for study authors, who often had to first locate the data before being able to complete the 2 × 2 tables. In addition, despite our efforts, data to resolve discrepancies or calculate 2 × 2 tables at commonly used cutoffs for sensitivity and specificity could not be obtained for 48 of 77 (62%) studies, most frequently because authors could not be contacted or because they did not have access to the data. This experience indicates that despite relatively extensive efforts to obtain additional data, unresolved discrepancies and missing data remain likely. All data were obtained with the first three out of five attempted contacts, suggesting that more extensive efforts may be of low yield. In particular, telephone contact did not produce any additional information.

Limitations

Receiving data was a function of not only whether authors were accessible and willing to send data but also whether they were able to communicate in English. As a result, a slightly higher yield may have been possible if non-English-speaking authors had been contacted in their native language.

Conclusions

Contacting authors of studies evaluating the diagnostic accuracy of serum biomarkers for hepatic fibrosis and xcirrhosis in hepatitis C patients to obtain additional data was successful for 29 of 77 studies (38%). This resulted in changes in estimates and reclassification of two tests for hepatic fibrosis and the inclusion of an additional test for which data had previously been insufficient to calculate an estimate. Systematic reviewers with adequate resources should consider contacting authors

of studies with missing or discrepant data, especially if these studies were published within the past 4 years. However, despite relatively extensive efforts, we were unable to obtain data to resolve discrepancies or complete 2×2 tables for 48 of 77 studies. Given that three attempts were needed to obtain even that level of information, more efficient mechanisms of achieving better access to information are needed. Requiring authors of studies on diagnostic accuracy to provide the 2×2 tables at commonly used cutoffs in the original study publication (or in the results of publicly available trial registries such as ClinicalTrials.gov) or requiring authors to make their datasets publicly available would save time, enable systematic reviewers to synthesize data more readily and completely, and enable more transparent verification of authors' estimates of diagnostic accuracy.

Abbreviations

ALT: alanine aminotransferase; API: age platelet index; APRI: aspartate aminotransferase to platelet ratio index; AST: aspartate aminotransferase; AUROC: area under the receiver operating characteristic.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

SS and AG analyzed the data and drafted the manuscript. RC conceived the study and revised the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We would like to thank the following corresponding and other authors for responding to our request for additional study data: Alfredo Alberti, M.D., Simona Bota, M.D., Marc Bourlière, M.D., Jérôme Boursier, M.D., Rafael Bruck, M.D., Mary J. Burton, M.D., Paul Calès, M.D., Laurent Castera, M.D., Ramsey C. Cheung, M.D., Kin Jip Cheung, Ph.D., Dana Crisan, M.D., Ph.D., Mireen Friedrich-Rust, M.D., Naveen Gara, M.D., Edoardo G. Giannini, M.D., Ph.D., Mircea Grigorescu, M.D., Ph.D., Jérôme Guéchot, Pharm.D., Ph.D., Kwang-Hyub Han, M.D., Philippe Halfon, M.D., Ph.D., Pharm.D., Angelo Iacobellis, M.D., Dong Joon Kim, M.D., Sheng-Nan Lu, M.D., M.P.H., Ph.D., Gilles Morali, M.D., Joel Mossong, Ph.D., Rokaya Mohamed El-Sayed, M.D., Mohamed M. Omran, Ph.D., Jae Jun Park, M.D., Keyur Patel, M.D., Ph.D., Guillaume Pénaranda, M.Sc., William Rosenberg, Ph.D., Christoph Sarrazin, M.D., Leonardo L. Schiavon, M. D., Ph.D., Giada Sebastiani, M.D., Roxana Sirli, M.D., Ph.D., Roberto Testa, M.D., David L. Thomas, M.D., M.P.H., Hans Van Vlierberghe, M.D., Ph.D., Hanneke van Vuuren, Ph.D., Kentaro Yoshioka, M.D., Ph.D., Yusuf Yilmaz, M.D., and Jean-Pierre Zarski, M.D., Ph.D. We would also like to thank Bryce Lambert and Monica Fraenkel for their assistance contacting study authors.

Disclaimer

This project was funded under Contract No. HHSA 290-2012-00014I from the Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services. The authors of this article are responsible for its content, including any clinical treatment recommendations. No statement in this article should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

Author details

[1]The Pacific Northwest Evidence-based Practice Center, Department of Medical Informatics and Clinical Epidemiology, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, Mail Code: BICC, Portland, OR 97239, USA. [2]Department of Medicine, Oregon Health & Science University, Portland, OR, USA.

Received: 25 April 2014 Accepted: 29 August 2014
Published: 19 September 2014

References

1. Gibson CA, Bailey BW, Carper MJ, Lecheminant JD, Kirk EP, Huang G, Dubose KD, Donnelly JE: **Author contacts for retrieval of data for a meta-analysis on exercise and diet restriction.** *Int J Technol Assess Health Care* 2006, **22:**267–270.
2. Kelley GA, Kelley KS, Tran ZV: **Retrieval of missing data for meta-analysis: a practical example.** *Int J Technol Assess Health Care* 2004, **20:**296–299.
3. Higgins JPT, Green S: *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0.* The Cochrane Collaboration: [Updated March 2011]; 2011 [www.cochrane-handbook.org]
4. Balshem H, Stevens A, Ansari M, Norris S, Kansagara D, Shamliyan T, Chou R, Chung M, Moher D, Dickersin K: **Finding grey literature evidence and assessing for outcome and analysis reporting biases when comparing medical interventions.** In *AHRQ and the Effective Health Care Program. In Methods Guide for Effectiveness and Comparative Effectiveness Reviews.* Rockville: Agency for Healthcare Research and Quality: AHRQ Publication No 10(14)-EHC063-EF; 2013:19–20.
5. Mullan RJ, Flynn DN, Carlberg B, Tleyjeh IM, Kamath CC, LaBella ML, Erwin PJ, Guyatt GH, Montori VM: **Systematic reviewers commonly contact study authors but do so with limited rigor.** *J Clin Epidemiol* 2009, **62:**138–142.
6. Chou R, Cottrell EB, Wasson N, Rahman B, Guise J-M: **Screening for hepatitis C virus infection in adults: a systematic review for the U.S. Preventive Services Task Force.** *Ann Intern Med* 2013, **158:**101–108.
7. Chou R, Cottrell EB, Wasson N, Rahman B, Guise J-M: *Screening for Hepatitis C Virus Infection in Adults. Comparative Effectiveness Review No. 69. (Prepared by the Oregon Evidence-based Practice Center under Contract No. 290-2007-10057-I.).* Agency for Healthcare Research and Quality: Rockville; 2012.
8. Chou R, Wasson N: **Blood tests to diagnose fibrosis or cirrhosis in patients with chronic hepatitis C virus infection: a systematic review.** *Ann Intern Med* 2013, **158:**807–820.
9. Attallah AM, Abdallah SO, Attallah AA, Omran MM, Farid K, Nasif WA, Shiha GE, Abdel-Aziz AA, Rasafy N, Shaker YM: **Diagnostic value of fibronectin discriminant score for predicting liver fibrosis stages in chronic hepatitis C virus patients.** *Ann Hepatol* 2013, **12:**44–53.
10. Attallah AM, Omran MM, Farid K, El-Bendary M, Emran TM, Albannan MS, El-Dosoky I: **Development of a novel score for liver fibrosis staging and comparison with eight simple laboratory scores in large numbers of HCV-monoinfected patients.** *Clin Chim Acta* 2012, **413:**1725–1730.
11. Ben Jazia E, Kaabia N, Benabdelkader A, Khalifa M, Harrabi I, Braham A, Bahri F, Letaief A: **Noninvasive fibrosis markers for the prediction of significant fibrosis in patients with chronic hepatitis C virus infection in Tunisia.** *Infect Dis Clin Pract (Baltim Md)* 2009, **17:**385–387.
12. Cheung RC, Currie S, Shen H, Bini EJ, Ho SB, Anand BS, Hu K-Q, Wright TL, Morgan TR: **Group ftVH-S: Can we predict the degree of fibrosis in chronic hepatitis C patients using routine blood tests in our daily practice?** *J Clin Gastroenterol* 2008, **42:**827–834.
13. Crisan D, Radu C, Lupsor M, Sparchez Z, Grigorescu MD, Grigorescu M: **Two or more synchronous combination of noninvasive tests to increase accuracy of liver fibrosis assessment in chronic hepatitis C; results from a cohort of 446 patients.** *Hepat Mon* 2012, **12:**177–184.
14. Ehsan N, Badr M, Raouf A, Gamal B: **Correlation between liver biopsy findings and different serum biochemical tests in staging fibrosis in Egyptian patients with chronic hepatitis C virus infection.** *Arab J Gastroenterol* 2008, **9:**7–12.
15. El-mezayen HA, El SAT, Shiha GE: **Role of hyaluronic acid, its degrading enzymes, degradation products, and ferritin in the assessment of fibrosis stage in Egyptian patients with chronic hepatitis C.** *Eur J Gastroenterol Hepatol* 2013, **25:**69–76.
16. Guechot J, Trocme C, Renversez J-C, Sturm N, Zarski J-P: **Group AHEFS: Independent validation of the Enhanced Liver Fibrosis (ELF) score in the ANRS HC EP 23 Fibrostar cohort of patients with chronic hepatitis C.** *Clin Chem Lab Med* 2012, **50:**693–699.
17. Iacobellis A, Fusilli S, Mangia A, Clemente R, Festa V, Giacobbe A, Facciorusso D, Niro G, Conoscitore P, Andriulli A: **Ultrasonographic and biochemical parameters in the non-invasive evaluation of liver fibrosis in hepatitis C virus chronic hepatitis.** *Aliment Pharmacol Ther* 2005, **22:**769–774.

18. Iacobellis A, Mangia A, Leandro G, Clemente R, Festa V, Attino V, Ricciardi R, Giacobbe A, Facciorusso D, Andriulli A: **External validation of biochemical indices for noninvasive evaluation of liver fibrosis in HCV chronic hepatitis.** *Am J Gastroenterol* 2005, **100:**868–873.
19. Leroy V, Monier F, Bottari S, Trocme C, Sturm N, Hilleret MN, Morel F, Zarski JP: **Circulating matrix metalloproteinases 1, 2, 9 and their inhibitors TIMP-1 and TIMP-2 as serum markers of liver fibrosis in patients with chronic hepatitis C: comparison with PIIINP and hyaluronic acid.** *Am J Gast* 2004, **99:**271–279.
20. Mossong J, Bill S, Hawotte K, Gilson G, Knolle U, Weber J, Roskams T, Arendt V: **Predicting significant fibrosis in hepatitis C patients in Luxembourg using serological markers.** *Bull Soc Sci Med Grand Duche Luxemb* 2011, **1:**19–30.
21. Saitou Y, Shiraki K, Yamanaka Y, Yamaguchi Y, Kawakita T, Yamamoto N, Sugimoto K, Murata K, Nakano T: **Noninvasive estimation of liver fibrosis and response to interferon therapy by a serum fibrogenesis marker, YKL-40, in patients with HCV-associated liver disease.** *World J Gastroenterol* 2005, **11:**476–481.
22. Sebastiani G, Vario A, Guido M, Alberti A: **Performance of noninvasive markers for liver fibrosis is reduced in chronic hepatitis C with normal transaminases.** *J Vir Hep* 2008, **15:**212–218.
23. Sebastiani G, Castera L, Halfon P, Pol S, Mangia A, Di Marco V, Pirisi M, Voiculescu M, Bourliere M, Alberti A: **The impact of liver disease aetiology and the stages of hepatic fibrosis on the performance of non-invasive fibrosis biomarkers: an international study of 2411 cases.** *Aliment Pharmacol Ther* 2011, **34:**1202–1216.
24. Sebastiani G, Halfon P, Castera L, Mangia A, Di Marco V, Pirisi M, Voiculescu M, Bourliere M, Alberti A: **Comparison of three algorithms of non-invasive markers of fibrosis in chronic hepatitis C.** *Aliment Pharmacol Ther* 2012, **35:**92–104.
25. Stibbe KJM, Verveer C, Francke J, Hansen BE, Zondervan PE, Kuipers EJ, De Knegt RJ, Van Vuuren AJ: **Comparison of non-invasive assessment to diagnose liver fibrosis in chronic hepatitis B and C patients.** *Scand J Gastroenterol* 2011, **46:**962–972.
26. Adler M, Gulbis B, Moreno C, Evrard S, Verset G, Golstein P, Frotscher B, Nagy N, Thiry P: **The predictive value of FIB-4 versus FibroTest, APRI, FibroIndex and Forns index to noninvasively estimate fibrosis in hepatitis C and nonhepatitis C liver diseases.** *Hepatology* 2008, **47:**762–763.
27. Ahmad W, Ijaz B, Javed FT, Gull S, Kausar H, Sarwar MT, Asad S, Shahid I, Sumrin A, Khaliq S, Jahan S, Pervaiz A, Hassan S: **A comparison of four fibrosis indexes in chronic HCV: development of new fibrosis-cirrhosis index (FCI).** *BMC Gastroenterol* 2011, **11:**44.
28. Amorim TG, Staub GJ, Lazzarotto C, Silva AP, Manes J, Da Graca Ferronato M, Shiozawa MB, Narciso-Schiavon JL, Dantas-Correa EB, De Lucca Schiavon L: **Validation and comparison of simple noninvasive models for the prediction of liver fibrosis in chronic hepatitis C.** *Ann Hepatol* 2012, **11:**855–861.
29. Arabul M, Aslan F, Alper E, Akpinar Z, Celik M, Kandemir A, Vatansever S, Unsal B: **Simple non-invasive markers as a predictor of fibrosis and viral response in chronic hepatitis C patients.** *Turk J Gastroenterol* 2012, **23:**538–545.
30. Bota S, Sirli R, Sporea I, Focsa M, Popescu A, Danila M, Strain M, Sendroiu M, Deleanu A, Dan I: **A new scoring system for prediction of fibrosis in chronic hepatitis C.** *Hepat Mon* 2011, **11:**548–555.
31. Bourliere M, Penaranda G, Ouzan D, Renou C, Botta-Fridlund D, Tran A, Rosenthal E, Wartelle-Bladou C, Delasalle P, Oules V, Portal I, Castellani P, Lecomte L, Rosenthal-Alliere MA, Halfon P: **Optimized stepwise combination algorithms of non-invasive liver fibrosis scores including Hepascore in hepatitis C virus patients.** *Aliment Pharmacol Ther* 2008, **28:**458–467.
32. Boursier J, Bacq Y, Halfon P, Leroy V, De Ledinghen V, De Muret A, Bourlière M, Sturm N, Foucher J, Oberti F, Rousselet MC, Cales P: **Improved diagnostic accuracy of blood tests for severe fibrosis and cirrhosis in chronic hepatitis C.** *Eur J Gastroenterol Hepatol* 2009, **21:**28–38.
33. Boursier J, De Ledinghen V, Zarski J-P, Rousselet M-C, Sturm N, Foucher J, Leroy V, Fouchard-Hubert I, Bertrais S, Gallois Y, Oberti F, Dib N, Cales P: **A new combination of blood test and fibroscan for accurate non-invasive diagnosis of liver fibrosis stages in chronic hepatitis C.** *Am J Gastroenterol* 2011, **106:**1255–1263.
34. Burton MJ, Sunesara I, Penman A, Pham H, Oliver N, Young CA, McGloster N, McGuire BM: **Comparing the aspartate aminotransferase (AST) to platelet ratio index (APRI) between African American and white veterans with chronic hepatitis C.** *South Med J* 2011, **104:**309–314.
35. Calès P, Boursier J, Bertrais S, Oberti F, Gallois Y, Fouchard-Hubert I, Dib N, Zarski JP, Rousselet MC, Multicentric G: **Optimization and robustness of blood tests for liver fibrosis and cirrhosis.** *Clin Biochem* 2010, **43:**1315–1322.
36. Calès P, Boursier J, De Lédinghen V, Halfon P, Bacq Y, Leroy V, Dib N, Oberti F, Sawadogo A, Rousselet MC, Lunel F: **Evaluation and improvement of a reliable diagnosis of cirrhosis by blood tests.** *Gastroenterol Clin Biol* 2008, **32:**1050–1060.
37. Calès P, Oberti F, Michalak S, Hubert-Fouchard I, Rousselet M, Konate A, Gallois Y, Ternisien C, Chevailler A, Lunel F: **A novel panel of blood markers to assess the degree of liver fibrosis.** *Hepatology* 2005, **42:**1373–1381.
38. Castéra L, Vergniol J, Foucher J, Le Bail B, Chanteloup E, Haaser M, Darriet M, Couzigou P, De Lédinghen V: **Prospective comparison of transient elastography, Fibrotest, APRI, and liver biopsy for the assessment of fibrosis in chronic hepatitis C.** *Gastroenterology* 2005, **128:**343–350.
39. Cheung KJ, Tilleman K, Deforce D, Colle I, Moreno C, Gustot T, Van Vlierberghe H: **Usefulness of a novel serum proteome-derived index FI-PRO (fibrosis-protein) in the prediction of fibrosis in chronic hepatitis C.** *Eur J Gastroenterol Hepatol* 2011, **23:**701–710.
40. Cobbold J, Crossey M, Colman P, Goldin R, Murphy P, Patel N, Fitzpatrick J, Vennart W, Thomas H, Cox I, Taylor-Robinson S: **Optimal combinations of ultrasound-based and serum markers of disease severity in patients with chronic hepatitis C.** *J Viral Hepat* 2010, **17:**537–545.
41. Cross TJ, Calvaruso V, Maimone S, Carey I, Chang TP, Pleguezuelo M, Manousou P, Quaglia A, Grillo F, Dhillon AP, Dusheiko GM, Burroughs AK, Harrison PM: **Prospective comparison of Fibroscan, King's score and liver biopsy for the assessment of cirrhosis in chronic hepatitis C infection.** *J Viral Hepat* 2010, **17:**546–546.
42. Cross TJS, Rizzi P, Berry PA, Bruce M, Portmann B, Harrison PM: **King's Score: an accurate marker of cirrhosis in chronic hepatitis C.** *Eur J Gastroenterol Hepatol* 2009, **21:**730–738.
43. Deghady A, Abdou A, El-Neanaey WA, Diab I: **Association of genetic polymorphism -670A > G in the Fas gene and serum markers AST platelet ratio index, AST/ALT with significant fibrosis and cirrhosis in chronic hepatitis C.** *Genet Test Mol Biomarkers* 2012, **16:**531–535.
44. El-Sayed R, Fahmy M, El Koofy N, El-Raziky M, El-Hawary M, Helmy H, El-Akel W, El-Hennawy A, El-Karaksy H: **Can aspartate aminotransferase to platelet ratio index replace liver biopsy in chronic hepatitis C?** *Trop Gastroenterol* 2011, **32:**267–272.
45. Fabris C, Smirne C, Toniutto P, Colletta C, Rapetti R, Minisini R, Falleti E, Leutner M, Pirisi M: **Usefulness of six non-proprietary indirect markers of liver fibrosis in patients with chronic hepatitis C.** *Clin Chem Lab Med* 2008, **46:**253–259.
46. Fontana RJ, Goodman ZD, Dienstag JL, Bonkovsky HL, Naishadham D, Sterling RK, Su GL, Ghosh M, Wright EC, Group H-CT: **Relationship of serum fibrosis markers with liver fibrosis stage and collagen content in patients with advanced chronic hepatitis C.** *Hepatology* 2008, **47:**789–798.
47. Fontanges T, Bailly F, Trepo E, Chevallier M, Maynard-Muet M, Nalet B, Beorchia S, Pillon D, Moindrot H, Froissart B, Slaoui M, Tinel X, Pradat P, Trepo C: **Discordance between biochemical markers of liver activity and fibrosis (Actitest-Fibrotest) and liver biopsy in patients with chronic hepatitis C.** *Gastroenterol Clin Biol* 2008, **32:**858–865.
48. Fouad SA, Esmat S, Omran D, Rashid L, Kobaisi MH: **Noninvasive assessment of hepatic fibrosis in Egyptian patients with chronic hepatitis C virus infection.** *World J Gastroenterol* 2012, **18:**2988–2994.
49. Friedrich-Rust M, Rosenberg W, Parkes J, Herrmann E, Zeuzem S, Sarrazin C: **Comparison of ELF.** *FibroTest and FibroScan for the non-invasive assessment of liver fibrosis. BMC Gastroenterol* 2010, **10:**103.
50. Gabrielli GB, Capra F, Casaril M, Squarzoni S, Tognella P, Dagradi R, De Maria E, Colombari R, Corrocher R, De Sandre G: **Serum laminin and type III procollagen in chronic hepatitis C. Diagnostic value in the assessment of disease activity and fibrosis.** *Clin Chim Acta* 1997, **265:**21–31.
51. Gara N, Zhao X, Kleiner DE, Liang TJ, Hoofnagle JH, Ghany MG: **Discordance among transient elastography, aspartate aminotransferase to platelet ratio index, and histologic assessments of liver fibrosis in patients with chronic hepatitis C.** *Clin Gastroenterol Hepatol* 2013, **11:**303–308. el.
52. Giannini E, Testa R: **Noninvasive diagnosis of fibrosis: the truth is rarely pure and never simple.** *Hepatology* 2003, **38:**1312–1313.
53. Grigorescu M, Rusu M, Neculoiu D, Radu C, Serban A, Catanas M, Grigorescu MD: **The FibroTest value in discriminating between insignificant and significant fibrosis in chronic hepatitis C patients.** *The Romanian experience. J Gastrointestin Liver Dis* 2007, **16:**31–37.

54. Halfon P, Bacq Y, De Muret A, Penaranda G, Bourliere M, Ouzan D, Tran A, Botta D, Renou C, Brechot M, Degott C, Paradis V: **Comparison of test performance profile for blood tests of liver fibrosis in chronic hepatitis C.** *J Hepatol* 2007, **46:**395–402.
55. Halfon P, Penaranda G, Renou C, Bourliere M: **External validation of FibroIndex.** *Hepatology* 2007, **46:**280–281. author reply 281–282.
56. Hsieh YY, Tung SY, Lee K, Wu CS, Wei KL, Shen CH, Chang TS, Lin YH: **Routine blood tests to predict liver fibrosis in chronic hepatitis C.** *World J Gastroenterol* 2012, **18:**746–753.
57. Ichino N, Osakabe K, Nishikawa T, Sugiyama H, Kato M, Kitahara S, Hashimoto S, Kawabe N, Harata M, Nitta Y, Murao M, Nakano T, Arima Y, Shimazaki H, Suzuki K, Yoshioka K: **A new index for non-invasive assessment of liver fibrosis.** *World J Gastroenterol* 2010, **16:**4809–4816.
58. Imbert-Bismut F, Ratziu V: **Laurence Pieroni L, Charlotte F, Benhamou Y, Poynard T, Group M: Biochemical markers of liver fibrosis in patients with hepatitis C virus infection: a prospective study.** *Lancet* 2001, **357:**1069–1075.
59. Islam S, Antonsson L, Westin J, Lagging M: **Cirrhosis in hepatitis C virus-infected patients can be excluded using an index of standard biochemical serum markers.** *Scand J Gastroenterol* 2005, **40:**867–872.
60. Lackner C, Struber G, Liegl B, Leibl S, Ofner P, Bankuti C, Bauer B, Stauber RE: **Comparison and validation of simple noninvasive tests for prediction of fibrosis in chronic hepatitis C.** *Hepatology* 2005, **41:**1376–1382.
61. Loaeza-del-Castillo A, Paz-Pineda F, Oviedo-Cárdenas E, Sánchez-Avila F, Vargas-Vorácková F: **AST to platelet ratio index (APRI) for the noninvasive evaluation of liver fibrosis.** *Ann Hepatol* 2008, **7:**350–357.
62. Lu SN, Wang JH, Liu SL, Hung CH, Chen CH, Tung HD, Chen TM, Huang WS, Lee CM, Chen CC, Changchien CS: **Thrombocytopenia as a surrogate for cirrhosis and a marker for the identification of patients at high-risk for hepatocellular carcinoma.** *Cancer* 2006, **107:**2212–2222.
63. Martinez SM, Fernández-Varo G, González P, Sampson E, Bruguera M, Navasa M, Jiménez W, Sánchez-Tapias JM, Forns X: **Assessment of liver fibrosis before and after antiviral therapy by different serum marker panels in patients with chronic hepatitis C.** *Aliment Pharmacol Ther* 2011, **33:**138–148.
64. Morali G, Maor Y, Klar R, Braun M, Ari ZB, Bujanover Y, Zuckerman E, Boger S, Halfon P: **Fibrotest-Actitest: the biochemical marker of liver fibrosis–the Israeli experience.** *Isr Med Assoc J* 2007, **9:**588–591.
65. Morra R, Munteanu M, Bedossa P, Dargere D, Janneau JL, Paradis V, Ratziu V, Charlotte F, Thibault V, Imbert-Bismut F, Poynard T: **Diagnostic value of serum protein profiling by SELDI-TOF ProteinChip compared with a biochemical marker, FibroTest, for the diagnosis of advanced fibrosis in patients with chronic hepatitis C.** *Aliment Pharmacol Ther* 2007, **26:**847–858.
66. Omran MM, Farid K, Emran TM, Attallah AA: **Fibro-(alpha) score as a simple and useful non-invasive test for predicting significant liver fibrosis in chronic hepatitis C patients.** *Arab J Gastroenterol* 2011, **12:**74–79.
67. Parise ER, Oliveira AC, Figueiredo-Mendes C, Lanzoni V, Martins J, Nader H, Ferraz ML: **Noninvasive serum markers in the diagnosis of structural liver damage in chronic hepatitis C virus infection.** *Liver Int* 2006, **26:**1095–1099.
68. Park SH, Kim CH, Kim DJ, Suk KT, Park JH, Cheong JY, Cho SW, Hwang SG, Lee YJ, Cho M, Yang JM, Park HY, Kim YB: **Diagnostic value of multiple biomarker panel for prediction of significant fibrosis in chronic hepatitis C.** *Clin Biochem* 2011, **44:**1396–1399.
69. Park JJ, Park JY, Kimdo Y, Park YN, Ahn SH, Chon CY, Han KH: **Prediction of significant fibrosis in chronic hepatitis C patients with normal ALT.** *Hepatogastroenterology* 2011, **58:**1321–1327.
70. Parkes J, Guha I, Roderick P, Harris S, Cross R, Manos M, Irving W, Zaitoun A, Wheatley M, Ryder S, Rosenberg W: **Enhanced Liver Fibrosis (ELF) test accurately identifies liver fibrosis in patients with chronic hepatitis C.** *J Viral Hepatitis* 2010, **18:**23–31.
71. Patel K, Benhamou Y, Yoshida EM, Kaita KD, Zeuzem S, Torbenson M, Pulkstenis E, Subramanian GM, McHutchison JG: **An independent and prospective comparison of two commercial fibrosis marker panels (HCV FibroSURE and FIBROSpect II) during albinterferon alfa-2b combination therapy for chronic hepatitis C.** *J Vir Hep* 2009, **16:**178–186.
72. Poynard T, Imbert-Bismut F, Ratziu V, Chevret S, Jardel C, Moussalli J, Messous D: **Degos F, for the Gcg: Biochemical markers of liver fibrosis in patients infected by hepatitis C virus: longitudinal validation in a randomized trial.** *J Vir Hep* 2002, **9:**128–133.
73. Poynard T, McHutchison J, Manns M, Myers R, Albrecht J: **Biochemical surrogate markers of liver fibrosis and activity in a randomized trial of peginterferon alfa-2b and ribavirin.** *Hepatology* 2003, **38:**481–492.
74. Rosenberg W, Voelker M, Thiel R, Becka M, Burt A, Schuppan D, Hubscher S, Roskams T, Pinzani M, Arthur M: **Serum markers detect the presence of liver fibrosis: a cohort study.** *Gastroenterology* 2004, **127:**1704–1713.
75. Schneider AR, Teuber G, Kriener S, Caspary WF: **Noninvasive assessment of liver steatosis, fibrosis and inflammation in chronic hepatitis C virus infection.** *Liver Int* 2005, **25:**1150–1155.
76. Schneider AR, Teuber G, Paul K, Nikodem A, Duesterhoeft M, Caspary WF, Stein J: **Patient age is a strong independent predictor of 13C-aminopyrine breath test results: a comparative study with histology, duplex-Doppler and a laboratory index in patients with chronic hepatitis C virus infection.** *Clin Exp Pharmacol Physiol* 2006, **33:**300–304.
77. Shlomai A, Halfon P, Goldiner I, Zelber-Sagi S, Halpern Z, Oren R, Bruck R: **Serum bile acid levels as a predictor for the severity of liver fibrosis in patients with chronic hepatitis C.** *J Viral Hepat* 2013, **20:**95–102.
78. Sirli R, Sporea I, Bota S, Popescu A, Cornianu M: **A comparative study of non-invasive methods for fibrosis assessment in chronic HCV infection.** *Hepat Mon* 2010, **10:**88–94.
79. Snyder N, Gajula L, Xiao S-Y, Grady J, Luxon B, Lau DT-Y, Soloway R, Petersen J: **APRI: An easy and validated predictor of hepatic fibrosis in chronic hepatitis C.** *J Clin Gastroenterol* 2006, **40:**535–542.
80. Snyder N, Nguyen A, Gajula L, Soloway R, Xiao SY, Lau DTY, Petersen J: **The APRI may be enhanced by the use of the FIBROSpect II in the estimation of fibrosis in chronic hepatitis C.** *Clin Chim Acta* 2007, **381:**119–123.
81. Testa R, Testa E, Giannini E, Borro P, Milazzo S, Isola L, Ceppa P, Lantieri PB, Risso D: **Noninvasive ratio indexes to evaluate fibrosis staging in chronic hepatitis C: role of platelet count/spleen diameter ratio index.** *J Int Med* 2006, **260:**142–150.
82. Borsoi Viana MS, Takei K, Collarile Yamaguti DC, Guz B, Strauss E: **Use of AST platelet ratio index (APRI Score) as an alternative to liver biopsy for treatment indication in chronic hepatitis C.** *Ann Hepatol* 2009, **8:**26–31.
83. Westin J, Ydreborg M, Islam S, Alsio A, Dhillon AP, Pawlotsky JM, Zeuzem S, Schalm SW, Ferrari C, Neumann AU, Hellstrand K, Lagging M: **A non-invasive fibrosis score predicts treatment outcome in chronic hepatitis C infection.** *Scand J Gastroenterol* 2008, **43:**78–80.
84. Wilson L, Torbenson M, Astemborski J, Faruki H, Spoler C, Rai R, Mehta S, Kirk G, Nelson K, Afdhal N, Thomas D: **Progression of liver fibrosis among injection drug users with chronic hepatitis C.** *Hepatology* 2006, **43:**788–795.
85. Yilmaz Y, Yonal O, Kurt R, Bayrak M, Aktas B, Ozdogan O: **Noninvasive assessment of liver fibrosis with the aspartate transaminase to platelet ratio index (APRI): usefulness in patients with chronic liver disease.** *Hepat Mon* 2011, **11:**103–107.
86. Zarski J-P, Sturm N, Guechot J, Paris A, Zafrani E-S, Asselah T, Boisson R-C, Bosson J-L, Guyader D, Renversez J-C, Bronowicki JP, Gelineau MC, Tran A, Trocme C, De Ledinghen V, Lasnier E, Poujol-Robert A, Ziegler F, Bourliere M, Voitot H, Larrey D, Rosenthal-Allieri MA, Fourchard Hubert I, Bailly F, Vaubourdolle M: **Comparison of nine blood tests and transient elastography for liver fibrosis in chronic hepatitis C: the ANRS HCEP-23 study.** *J Hepatol* 2012, **56:**55–62.
87. Jaeschke R, Guyatt GH, Sackett DL: **Users' guides to the medical literature. III. How to use an article about a diagnostic test. B. What are the results and will they help me in caring for my patients? The Evidence-Based Medicine Working Group.** *JAMA* 1994, **271:**703–707.
88. Selph S, Chou R: *Impact of Contacting Study Authors on Systematic Review Conclusions: Diagnostic Tests for Hepatic Fibrosis. Research White Paper. (Prepared by the Pacific Northwest Evidence-based Practice Center under Contract No. 290-2012-00014-I). AHRQ Publication No. 14-EHC004-EF.* Agency for Healthcare Research and Quality: Rockville; 2014.

doi:10.1186/2046-4053-3-107
Cite this article as: Selph *et al.*: **Impact of contacting study authors to obtain additional data for systematic reviews: diagnostic accuracy studies for hepatic fibrosis.** *Systematic Reviews* 2014 **3**:107.