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From national HBV and HDV screenings to vaccination and treatment in healthcare workers: The Mauritanian pilot study

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1 **Title:** From national HBV and HDV screenings to vaccination and treatment in healthcare
2 workers: The Mauritanian pilot study

3 **Short Title:** Screening followed by vaccine or treatment for HBV/HDV infections in
4 Mauritanian healthcare workers

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19 **Keywords:** Seroprevalence, HBV, HDV, healthcare worker, Mauritania, prevention, test and
20 treat, HBV vaccine

21 **ABSTRACT**

22

23 **Objectives:** Hepatitis B and D infections are highly endemic in Mauritania, with prevalences
24 ranging from 10 to 20%. With the present prospective transversal pilot study, we aimed to
25 evaluate the prevalences of HBV, HCV, and HDV infections in healthcare workers (HCWs),
26 and offer treatment or vaccination as required.

27 **Methods:** At inclusion, each HCW was screened for anti-HBc Ab (followed by HBsAg assay
28 when positive). Additional biological analyses were performed for HBsAg+ cases. Depending
29 on the results, HBV vaccination or anti-viral treatment was offered.

30 **Results:** A total of 3,857 HCWs were included, of whom 1,363 tested negative for anti-HBc
31 Ab and received full vaccination. Of the 2,494 HCWs who were positive for anti-HBc Ab,
32 1,246 were positive for anti-HBs Ab and 418 were positive for HBsAg. Three HCWs were
33 positive for HBeAg; 66 and 18 had HBV DNA levels respectively >2,000 and >20,000
34 IU/mL; and 48 were positive for anti-HDV Ab among whom 10 were positive for HDV RNA.
35 HCV prevalence was 0.5%. Only seven HCWs fulfilled the criteria for treatment and five of
36 them were treated.

37 **Conclusion:** Few HCWs in Mauritania are immunised against HBV. The prevalences of anti-
38 HBc Ab and HBsAg observed in this work were similar to those observed in our earlier
39 works, whereas prevalence of active HDV infection was less high. HBV and HDV infections
40 are a serious health concern in Mauritania. New recommendations developed in accordance
41 with WHO guidelines should include mandatory HBV screening and immunisation for
42 HCWs.

43

44 INTRODUCTION

45 Chronic hepatitis B virus (HBV) infections are now recognised as a major public health
46 concern in need of an urgent response (1). They affect an estimated 257 million people
47 worldwide and may lead to such complications as cirrhosis and hepatocellular carcinoma
48 (HCC). In 2015, HBV infections caused around 900,000 deaths (2). The contagiousness of
49 HBV infections is higher in individuals with high-level viremia (HBV viral load). Upstream
50 of or in the absence of universal immunisation programmes, most HBV infections in high-
51 prevalence (>8%) countries are the result of mother-to-child transmission (MTCT) or early
52 childhood household horizontal transmission (3). However, parenteral HBV infection also
53 occurs, especially in healthcare settings (4, 5). Therefore, healthcare workers (HCWs) are
54 officially recognised as an at-risk population (6).

55 HBV infections are highly endemic in sub-Saharan Africa, with a high mortality rate linked to
56 cirrhosis and HCC. The World Health Organization (WHO) recently reported (7) that the
57 highest HBV prevalences are indeed observed in Africa, although HBV carrier prevalences
58 vary substantially between regions and prevention programmes. Particularly, HBV is highly
59 endemic in Mauritania, as we have shown in three previous collaborative studies (8-10).
60 Specifically, we have reported HBsAg prevalences in blood donors (BDs) (9), pregnant
61 women (10), and patient cohorts of respectively 16%, 10.7%, and 18.3%.

62 The hepatitis delta virus (HDV) is a defective HBV-satellite RNA virus that requires HBV's
63 envelope to assemble itself and propagate infection (11, 12). An estimated 5–10 % of HBsAg
64 carriers are also co-infected with HDV (13). This latter's prevalence has declined in Europe
65 (14), but it remains highly endemic in sub-Saharan Africa (15). Our recent work in Mauritania
66 also confirmed that up to 20% of HBV patients there are also positive for HDV (8). Co- or
67 super-infection by HDV may also result in severe acute or chronic liver diseases that progress

68 more rapidly to cirrhosis (16, 17). Again in Mauritania, we have shown that HDV co-
69 infection indeed worsens liver disease (8), with high cirrhosis and HCC rates (18). However,
70 only two Indian teams (19, 20) have examined the prevalence of HDV in HBV-infected
71 HCWs.

72 Considering this setting, and with the support of the Mauritanian Ministry of Health (MMoH),
73 we designed a pilot study with the primary objective of evaluating the prevalence of
74 parenterally transmitted hepatitis viruses (HBV, HCV, and HDV) in Mauritanian HCWs and
75 the consequences of those infections in terms of liver disease. The study was also an
76 opportunity to provide vaccination when possible in a setting where it is not mandatory.

77 The study's secondary objectives were to estimate: 1) hepatitis B, C and D exposure rates
78 (proportion of subjects with past infections), 2) the proportion of immunised HCWs
79 (vaccinated against HBV), 3) the number of HCWs requiring prevention (previously non-
80 exposed), 4) the number of HCWs requiring treatment (infected with liver abnormalities
81 and/or treatment criteria; tenofovir was supplied gratuitously by the MMoH), and, 5) the
82 number of HCWs who received vaccination against HBV.

83

84 **PATIENTS AND METHODS**

85 The present prospective screening study was conducted from 1 October 2014 to 31 December
86 2016. It was part of a national anti-hepatitis programme supported by the MMoH and
87 implemented by the Mauritanian National Institute of Hepato-Virology (INHV) and the
88 Mauritanian National Institute of Public Health Research (INRSP) in partnership with
89 relevant healthcare institutions.

90 **Patients**

91 Statement of ethics

92 The study was performed in accordance with the Declaration of Helsinki and approved by the
93 National Ethics Committee of the MMoH (No. 000002-04132016).

94 Recruitment of HCWs

95 Locations for HCW screening were selected according to the country's health institutions map
96 with the objective of maintaining a balance between the various districts. At each
97 participating institution, the medical/paramedical staff was provided with all necessary
98 information from the organising committee. HCWs were mainly recruited in urban hospitals. The
99 recruitment of rural HCWs was limited due to transportation difficulties. Indeed, the capital,
100 Nouakchott, is home to 80% of the Mauritanian population and the majority of recruited HCWs
101 (57.8%) worked in that city. Most of the other HCWs were also urban, as hospitals are generally
102 located in towns. Only 15% (589) of the recruited HCWs lived in a rural environment.

103

104 *1st visit*

105 HCWs were given the opportunity to have their serological HBV statuses screened. After
106 provision of informed consent, a blood sample was taken to test for anti-HBc antibodies (Ab)
107 and, if positive, for HBsAg. An epidemiological questionnaire was used to collect
108 demographic and socio-economic data.

109 *2nd visit*

110 For HCWs with HBV infection (HBsAg-positive), a second medical visit was scheduled to
111 take another blood sample for additional analyses (HBeAg, Alanine aminotransferase (ALT)
112 level, HBV DNA level).

113 For HCWs who were negative for anti-HBc Ab, an HBV vaccine or booster was offered
114 during the second visit.

115 *3rd visit*

116 A third medical visit was also offered to HCWs to share final results, explain diagnoses, and
117 discuss options (medical follow-up and treatment in case of HCV/HBV infection or HDV co-
118 infection).

119 Figure 1 summarizes the algorithm used to search for hepatitis serological markers and
120 manage HCWs according to their results.

121 Inclusion criteria

122 All HCWs, including medical or paramedical students, who accepted to participate and
123 provided informed consent, were included.

124 Exclusion criteria

125 All HCWs who were aware of their serological status or had been treated for chronic
126 hepatitis, HCC, or cirrhosis were excluded.

127 **Specimen collection and assays**

128 Specimens

129 Eight mL of whole blood were collected during the first and second visits. Samples were
130 stored at -80°C.

131 Biological analyses

132 The following analyses were performed on fresh or frozen samples by the INRSP for all
133 included HCWs: anti-HBc Ab (Hepanostika anti-HBc UNI-FORM, Biomérieux, France),

134 HBsAg (Hepanostika HBsAg Ultra, Biomérieux, France), and anti-HCV Ab (Multisure, MP
135 Biomedicals, USA). Neutralisation of HBsAg was done in HBsAg-positive HCWs when
136 HBV DNA was undetectable (n=120).

137 In HBsAg-negative / anti-HBc-positive samples, anti-HBs Ab were screened using
138 Hepanostika Anti-HBs Total II (BioMerieux, France). The samples of HCWs negative for
139 anti-HBc Ab were retrospectively tested with a point of care (POC) test for anti-HBs Ab
140 (Quick Profile HBsAb Test Card, Nephrotek, France) to verify vaccination status. The lower
141 limit of detection of the POC was 30 mIU/mL.

142 In HBsAg-positive samples, anti-HDV Ab (ETI-AB-DELTAK-2, Diasorin, Italy), HBeAg
143 and anti-HBe Ab (HBe/Anti-HBe VIDAS, BioMerieux, France), AST and ALT (AST and
144 ALT/Gpt, Biosystems, France) were assessed.

145 Molecular assays and additional serological assays were performed at Angers University
146 Hospital. The Aptima™ HBV Quant Assay on the Panther system (Hologic, USA) was used
147 to determine HBV viral loads for all HBs Ag-positive samples and in 69 HCWs who had
148 isolated anti-HBc Ab (to detect possible occult HBV infection (OBI)). The EurobioPlex HDV
149 kit (Eurobio-Ingen, Les Ullis, France) was used to quantify HDV viral loads. HDV genotype
150 was determined after sequencing the R0 region (21). Sequences were analysed using MEGA6
151 to infer phylogenetic trees.

152

153 **Data analysis**

154 For sub-analyses, the HCWs were stratified according to sex, age, occupation, salary, and
155 ethnicity. The results were analysed using Statistical Package for Social Sciences (SPSS)
156 15.0. Statistical significance was determined using the Student's t-test for quantitative
157 variables and the chi-square or Fisher exact test for qualitative variables: p-values <0.05 were

158 considered significant. Relationships between risk factors and HBV & HDV contact and
159 HDV RNA positivity were assessed by calculating the odds ratio (OR) using univariate
160 logistic regression. When a p-value < 0.1 was reached in the univariate logistic for HBV
161 contact, the variables were entered into the fully adjusted logistic model including all
162 variables, and their adjusted OR (aOR) was calculated.

163 **RESULTS**

164 A total of 3,857 HCWs from 13 districts participated in the study. Table 1 provides a
165 summary of their socio-professional profiles and other epidemiological characteristics.

166 Table 2 describes the serological results for HBV, HDV and HCV.

167 There were 1,363 (35.54%) anti-HBc Ab-negative HCWs. These subjects thus had no past
168 HBV infections and were therefore classified as ‘at risk’. All of them accepted the proposition
169 for HBV vaccination and received a full course of it (i.e., three doses of the recombinant
170 vaccine at zero, one, and six months). Anti-HBs Ab were searched retrospectively in the
171 samples collected from these HCWs before vaccination. Only 103 subjects (7.6%) had
172 isolated anti-HBs Ab (>30 mIU/mL), most likely representing forgotten or unknown previous
173 vaccination.

174 There were 2,494 anti-HBc Ab-positive HCWs, and 1,367 of them had anti-HBs Ab.

175 A total of 418 HCWs were HBsAg-positive, and among them, only three were HBeAg-
176 positive (all three had ALT levels greater than twice the upper normal limit (UNL) and HBV
177 DNA levels >20,000 IU/mL). Among the HBsAg-positive HCWs, 66 and 18 had HBV DNA
178 levels respectively >2,000 and >20,000 IU/mL. Moreover, 48 HCWs had anti-Delta Ab and in
179 10 of them (20.8%) HDV RNA was detectable. HDV genotypes could be determined for 9 of
180 the 10 patients with HDV RNA and all belonged to HDV-1.

181 Globally, only seven HCWs had ALT greater than twice the UNL and two of them were co-
182 infected with HDV.

183 HBV DNA was undetectable in the subset of 69 HCWs with isolated anti-HBc Ab who were
184 tested for it.

185 Concerning HCV, only 19 of the 3,857 HCWs were positive for anti-HCV Ab, i.e., a
186 prevalence of 0.5%.

187 Table 3 compares the characteristics of HCWs with previous HBV exposure (anti-HBc Ab-
188 positive) grouped with those who showed current infection (HBs Ag-positive) to HCWs who
189 were free of previous contact with HBV (anti-HBc Ab-negative) and thus at risk of
190 subsequent HBV exposure, i.e., candidates for vaccination.

191 In multivariate analysis, the factors independently linked to HBsAg were sex and the presence
192 of anti-HCV Ab. Age was not predictive of HBsAg positivity (data not shown). Male sex was
193 independently and significantly linked to anti-HBc Ab positivity (aOR 1.8, 95% CI 1.6-2.1).
194 Interestingly, Pulaars had a lower risk of HBV contact than did the other ethnic groups.

195 We also found a significant difference between students (i.e., the youngest of the HCWs) and
196 non-students for the presence of anti-HBc Ab (47.3% vs. 68.7%, $p < 0.001$). The risk of HBV
197 contact in students was two to five-times lower than that of other occupations (aOR 0.5, 95%
198 CI 0.4-0.7 for nursing students and aOR 0.2, 95% CI 0.1-0.3 for medical students). We found
199 no predictive factors associated with HDV contact or HDV RNA positivity due to a too small
200 number of subjects.

201 A comparison of HCWs who were positive for HBsAg to those who had HDV co-infection
202 markers found no significant difference between the two groups, including as concerns age
203 (Table 4). Similarly, no differences were found when comparing HDV RNA-positive to HDV
204 RNA-negative HCWs.

205 Only five subjects among the seven who met virological and biological treatment criteria
206 returned for their results and received thereafter tenofovir (three HCWs with HBV infections)
207 or pegylated interferon (two HCWs with delta co-infection and abnormal liver tests). As of
208 this writing, they are still receiving follow-up from a specialist.

209

210 **DISCUSSION**

211 As of our study, HBV screening and vaccination were not mandatory for HCWs in
212 Mauritania. Moreover, there were neither requirements to declare blood exposure nor
213 recommendations for what to do in case of such events.

214 Given the high prevalence of HBV and HDV infections in Mauritania (8, 9), it was important
215 to determine the seroprevalences of HBV and HBV-HDV co-infection in HCWs.

216 The pilot study we report here is the first to assess the prevalence of viral hepatitis in
217 Mauritanian HCWs. It furthermore gave us an opportunity to implement HCW screening and
218 prevention measures, which should contribute to reducing HBV cross-exposure between
219 HCWs and patients.

220 We included 3,857 geographically-distributed HCWs, i.e., more than half of Mauritania's
221 entire population of HCWs (n=6,739), in our study.

222 We found a prevalence of 10.8% for HBsAg in Mauritanian HCWs. Compared to our earlier
223 works, that rate is lower than those of BDs or patients (8, 9) but comparable to that of
224 pregnant women (10.7%) (10).

225 Anti-HBc Ab were found in 64% of HCWs. That rate too compares to our previous studies
226 (10) and shows the population's large-scale exposure to HBV. Only 8% of HCWs were
227 positive for anti-HBs Ab, with no markers of HBV infection; this means that a very small
228 proportion of HCWs are immunised against HBV and WHO recommendations for medical
229 and paramedical staff are unmet. Our results do, however, validate our chosen algorithm

230 (vaccination when HCWs were negative for anti-HBc Ab). As such, a tremendous effort is
231 required to increase the proportion of vaccinated children (a HBV vaccination schedule has
232 been implemented at birth for more than five years in the country). Moreover, it remains
233 necessary to systematically screen and immunise HCWs before they are recruited.

234 Probably due to its rarity in this context, we detected no OBIs in a subset of HCWs.
235 Anti-HCV Ab were found in only 0.5% of the HCWs, showing that HCV is not a public
236 health problem in Mauritania. In contrast, the prevalence of anti-HDV Ab in HBV-infected
237 HCWs was relatively high (11%), albeit less than those found previously in BDs (20.1%),
238 pregnant women (14%), and patients (19%) (8-10). A small number (20.3%, 10/48) of HCWs
239 positive for anti-HDV had detectable HDV RNA (lower than in our previous findings) (10).

240 We can therefore suggest that HDV infections may evolve favourably in some subjects. Most
241 of the patients positive for HDV RNA were men (9/10), which is consistent with our previous
242 studies (8-10, 18). We found no differences between HDV RNA-detectable and -undetectable
243 subjects, except in terms of sex.

244 Numerous studies on HCWs have shown that the prevalence of hepatitis viral infections in
245 that population varies widely according to the prevalence of them in and the preventive
246 measures implemented by the concerned countries. In Africa, recent studies performed in
247 Sierra Leone (22), Uganda (23), Congo (24), Cameroon (25), and Nigeria (26) also showed a
248 relatively high prevalence of HBV infections in HCWs, ranging from 1.1% to 18.6%.

249 However, the prevalence of HDV infections was not assessed in most of these works,
250 probably due to a lack of serological tests. Our team performed a study in Tokombéré
251 Hospital (25) in the north of Cameroon, a country where delta infections are also relatively
252 common (27). In that study, we found very high prevalences of HBV and HDV (91% of the
253 medical staff was positive for anti-HBc Ab, 18% for HBsAg, 35% for anti-HDV Ab). The
254 authors of another study performed in North Africa reported a prevalence in HCWs that was

255 relatively low but nonetheless higher than that of the general population, and furthermore
256 correlated with blood exposure (28).

257 When we compared the various risk factors and their association with HBV or HDV
258 infections, we found that only students and Pulaars had less exposure to HBV. For students,
259 this is probably due to their younger age; as for the Pulaars, we have no explanation. HCWs
260 with higher salaries (more than MRU 50,000) were more greatly exposed. This observation
261 may be attributable to their higher social status (29), which gives better access to healthcare
262 and thus greater exposure to nosocomial infections.

263 In our study as in most epidemiological studies worldwide (30), men were more frequently
264 positive for HBV infection.

265 No major differences were found between our present and previous studies except for HDV
266 prevalence (lower here). Concerning the clinical impact of HBV or HBV-HDV co-infection,
267 it seems that most infected HCWs in our study were inactive carriers. Only 4.3% of the
268 HCWs infected with HBV had HBV DNA levels >20,000 IU/mL and only 10 subjects,
269 including two delta co-infected HCWs, had elevated ALT. Lastly, very few HCWs fulfilled
270 the biological or virological criteria for treatment and received it thereafter.

271 Lastly, the data we present are sufficiently representative to determine the epidemiological
272 status of this particular socio-professional category in Mauritania.

273 In conclusion, with the present study, we were able to: 1) screen most HCWs in the country,
274 2) vaccinate more than 1,300 non-immunised HCWs against HBV, 3) treat or follow up
275 infected HCWs, an action that could reduce the risk of HCW-to-patient HBV transmission,
276 and 4) explain universal prevention measures to HCWs, thereby reducing the number of at-
277 risk practices.

278 Also with this study, we confirmed our previous findings, namely that HBV and HBV-HDV
279 co-infections are a serious health problem in Mauritania. Moreover, we showed that

280 prevention measures (i.e., HBV vaccination at a young age and other universal prevention
281 measures) for HCWs are insufficiently implemented in the country. The Mauritanian hepatitis
282 B programme (PNLH) must be largely reinforced. As this study was part of an initiative by
283 the MMoH, it is highly likely that these new recommendations based on WHO guidelines and
284 including mandatory screening and immunisation of HCWs will soon be widely implemented
285 across the country.

286

287 **CONFLICT OF INTEREST: NONE**

288

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292

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298

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377

378 **Table 1.** Characteristics of HCWs

Characteristics	N (%)	380
Sex		381
Male	1,733 (44.9)	382
Female	2,124 (55.1)	383
Age (years, median)	36.8 (29.1-47.5)	384
Ethnicity		385
Moor	2,814 (73.7)	386
Pulaar	792 (20.5)	387
Soninke	99 (2.6)	388
Wolof	83 (2.2)	389
Other	42 (1.1)	390
Occupation		391
Paramedical staff	1,189 (3.8)	392
Auxiliary healthcare staff	876 (22.7)	393
Nursing auxiliary	565 (14.6)	394
Nurse student	428 (11.1)	395
Medical student	300 (7.8)	396
Administrative staff	269 (7.0)	397
Medical staff	168 (4.4)	398
Senior healthcare technician	62 (1.6)	399
		400

401 Median value presented with interquartile range (IQR).

402

403 **Table 2.** Viral markers in HCWs

Viral markers	N (%)					
	HBc Ab	HBs Ab ¹	HBsAg	HBeAg	HDV Ab ²	HCV Ab
Positive (%)	2,494 (64.7)	1,470 (42.7)	418 (16.8)	3 (0.7)	48 (11.5)	19 (0.5)
Negative (%)	1,363 (35.3)	1,969 (57.3)	2,076 (83.2)	415 (99.3)	370 (88.5)	3,838 (99.5)
Total	3,857	3,439	2,494	418	418	3,857

404

405 ¹ Performed only in HCWs negative for HBsAg

406 ² Performed only in HCWs positive for HBsAg

407

408 **Table 3.** Demographic comparison of HCWs with markers of active (HBsAg) or past (anti-
 409 HBc Ab) infections and HCWs who had no serological signs of contact with HBV (all
 410 markers negative or positive for anti-HBs)

411

Risk factor	HBV contact, N (%)		<i>p</i> -value	OR (95% CI)	aOR (95% CI)
	Yes	No			
Sex					
Female	1,273 (59.9)	851 (40.1)	< 0.001	1	1
Male	1,221 (70.5)	512 (29.5)		1.6 (1.4-1.8)	1.8 (1.6-2.1)
Age (years)	39.2±10.3 [18.0-59.5]	37.9±10.4 [18.0-59.5]	< 0.001		
< 25 years	77 (56.2)	60 (43.8)	0.016	1	1
25-40 years	1,351 (63.6)	772 (36.4)		1.4 (1.0-1.9)	1.0 (0.7-1.4)
> 40 years	1,066 (66.8)	531 (33.2)		1.6 (1.0-2.2)	1.0 (0.7-1.4)
Ethnicity					
Moor	1,867 (65.7)	974 (34.3)	0.053	1	1
Pulaar	476 (60.1)	316 (39.9)		0.8 (0.7-0.9)	0.8 (0.6-0.9)
Soninke	67 (67.7)	32 (32.3)		1.1 (0.7-1.7)	1.1 (0.7-1.8)
Wolof	56 (67.5)	27 (32.5)		1.1 (0.7-1.7)	1.0 (0.6-1.6)
Other	28 (66.7)	14 (33.3)		1.1 (0.5-2.0)	0.8 (0.4-1.7)
Occupation					
Paramedical staff	811 (68.2)	378 (31.8)	< 0.001	1	1
Auxiliary healthcare staff	594 (67.8)	282 (32.2)		1.0 (0.8-1.2)	0.9 (0.8-1.1)
Nursing auxiliary	394 (69.7)	171 (30.3)		1.1 (0.9-1.3)	1.0 (0.8-1.3)
Nurse student	236 (55.1)	192 (44.9)		0.6 (0.5-0.7)	0.5 (0.4-0.7)
Medical student	108 (36.0)	192 (64.0)		0.3 (0.2-0.3)	0.2 (0.1-0.3)
Administrative staff	188 (69.9)	81 (30.1)		1.1 (0.8-1.4)	0.9 (0.7-1.3)
Medical staff	119 (70.8)	49 (29.2)		1.1 (0.8-1.6)	0.8 (0.6-1.2)
Senior healthcare technician	44 (71.0)	18 (29.0)		1.1 (0.7-2.0)	0.8 (0.5-1.5)
Monthly income in MRU					
< 50,000	344 (47.3)	384 (52.7)	< 0.001	1	NC
50,000-100,000	1,799 (68.4)	831 (31.6)		2.4 (2.0-2.9)	
> 100,000	351 (70.3)	148 (29.7)		2.6 (2.1-3.4)	

412

413 Age: mean ± SD [minimum-maximum]; MRU: Mauritanian ouguiya; P-values were obtained
 414 using chi-squared test for categorical variables and Fisher' exact test for sex and Student's t-
 415 test for age; OR: odds ratio; 95% CI: 95 % confidence interval; NC: not calculated due to a
 416 link between occupation and income; aOR: adjusted OR

417

418 **Table 4.** Comparison of HCWs positive for HDV Ab and negative for HDV Ab and comparison of HCWs positive for HDV RNA and negative
 419 for HDV RNA

Risk factor	HDV contact (Ab), N (%)			OR (95% CI)	HDV RNA			
	Yes	No	<i>p</i> -value		Positive	Negative	<i>p</i> -value	OR (95% CI)
Sex								
Female	17 (9.9)	154 (90.1)	0.439	1	1 (5.9)	16 (94.1)	0.059	1
Male	31 (12.6)	216 (87.4)		1.3 (0.7-2.4)	9 (29.0)	22 (71.0)		6.5 (0.8-57.0)
Age (years)	39.7±10.5	38.5±9.1	0.464		44.7±7.9	41.3±10.2	0.331	
Ethnicity								
Moor	35 (10.7)	293 (89.3)	0.644	1	9 (25.7)	26 (74.3)	0.583	1
Pulaar	11 (15.9)	58 (84.1)		1.6 (0.8-3.3)	1 (9.1)	10 (90.9)		0.3 (0.0-2.6)
Soninke	1 (11.1)	8 (88.9)		1.0 (0.1-8.6)	0	1 (100)		NA
Wolof	0 (0.0)	6 (100)		NA	0	0		NA
Others	1 (16.7)	5 (83.3)		1.7 (0.2-14.7)	0	1 (100)		NA
Occupation								
Paramedical staff	13 (11.3)	102 (88.7)	0.543	1	4 (30.8)	9 (69.2)	0.392	1
Auxiliary healthcare staff	18 (15.8)	96 (84.2)		1.5 (0.7-3.2)	1 (5.6)	17 (94.4)		0.1 (0.0-1.4)

Nursing auxiliary	8 (13.1)	53 (86.9)		1.2 (0.5-3.0)	2 (22.2)	7 (77.8)		0.8 (0.1-5.4)	420
Nurse student	2 (4.5)	42 (95.5)		0.4 (0.1-1.7)	0	2 (100)		NA	421
Medical student	2 (8.7)	21 (91.3)		0.8 (0.2-3.6)	1 (50.0)	1 (50.0)		2.3 (0.1-45.7)	422
Administrative staff	3 (8.1)	34 (91.9)		0.7 (0.2-2.6)	1 (33.3)	2 (66.7)		1.1 (0.1-16.3)	423
Medical staff	2 (12.5)	14 (87.5)		1.1 (0.2-5.5)	1 (50.0)	1 (50.0)		2.3 (0.1-45.7)	424
Senior healthcare Technician	0 (0.0)	8 (100)		NA	0	0		NA	425
ALT (IU/L)	21.2±8.9	21.5±13.3	0.875		21.1±5.7	21.2±10.5	0.975		426
AST (IU/L)	21.2±9.6	25.3±15.1	0.069		16.8±8.5	22.3±8.8	0.081		427
HVB DNA levels (log IU/mL)	2.15±1.2	2.18±1.2	0.862		1.8±1.3	2.2±1.2	0.660		428
Monthly income in MRU									429
< 50,000	4 (6.0)	63 (94.0)	0.153	1	1 (25.0)	3 (75.0)	0.392	1	430
50.000-100,000	39 (13.4)	251 (86.6)		2.5 (0.8-7.1)	6 (15.4)	33 (84.6)		0.7 (0.1-7.3)	431
> 100,000	5 (9.7)	56 (90.3)		1.4 (0.4-5.5)	2 (40.0)	3 (60.0)		2.0 (0.1-35.8)	432
									433

434

435 Age: mean ± SD; MRU: Mauritanian ouguiya; NA: non-applicable; P-values were obtained using Chi-squared test for categorical variables and

436 Fisher' exact test for sex and Student's t-test for age. OR: odds ratio; 95% CI: 95% confidence interval; aOR: adjusted OR

437

438 **Figure 1.** Algorithm used to search for hepatitis serological markers and manage HCWs
439 according to their results

440

441

